LTA
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Dates of Tests: Oct 26 ~Oct 31, 2017
Test Report S/N: LR500111710N
Test Site : LTA CO., LTD.

CERTIFICATION OF COMPLIANCE

FCC ID **ZABSH-350G**

APPLICANT **Seyoung Information & Telecommunication Co., Ltd.**

Equipment Class	**:**	**Part 15 Spread Spectrum Transmitter (DSS)**
Manufacturing Description	**:**	**WIWI**
Manufacturer	**:**	**Seyoung Information & Telecommunication Co., Ltd.**
Model name	**:**	**SH-350G**
Test Device Serial No.:	**:**	**Identical prototype**
Rule Part(s)	**:**	**FCC Part 15.247**
		Subpart C ; ANSI C-63.4-2014 / ANSI C-63.10-2013
Frequency Range	**:**	**2403 ~ 2481 MHz**
RF power	**:**	**Max 10.02 dBm – Conducted**
Data of issue	**:**	**October 31, 2017**

This test report is issued under the authority of:

Yong-Cheol Wang, Manager

The test was supervised by:

Hee-Cheon Kwon, Test Engineer

This test result only responds to the tested sample. It is not allowed to copy this report even partly without the allowance of the test laboratory. The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

NVLAP LAB Code.: 200723-0

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1. General information

1-1 Test Performed

Company name : LTA Co., Ltd.

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Quality control in the testing laboratory is implemented as per ISO/IEC 17025 which is the "General requirements for the competents of calibration and testing laboratory".

1-2 Accredited agencies

LTA Co., Ltd. is approved to perform EMC testing by the following agencies:

Agency	Country	Accreditation No.	Validity	Reference
NVLAP	U.S.A	200723-0	2017-09-30	ECT accredited Lab.
RRA	KOREA	KR0049	-	EMC accredited Lab.
FCC	U.S.A	649054	2019-04-13	FCC CAB
VCCI	JAPAN	R2133(10 m), C2307	Updating	VCCI registration
VCCI	JAPAN	T-2009	2017-12-23	VCCI registration
VCCI	JAPAN	G-563	2018-12-13	VCCI registration
IC	CANADA	5799A-1	2019-11-07	IC filing
KOLAS	KOREA	NO.551	2021-08-20	KOLAS accredited Lab.

2. Information about test item

2-1 Client & Manufacturer

Company name	:	Seyoung Information & Telecommunication Co., Ltd.
Address	:	298-2, Gongdan-dong, Gumi-Si, Gyeongsanbuk-do, South Korea
Tel / Fax	:	TEL No : +82-54-463-2300 / FAX No : +82-54-463-2106

2-2 Equipment Under Test (EUT)

Model name	:	SH-350G
Serial number	:	Identical prototype
Date of receipt	:	October 26, 2017
EUT condition	:	Pre-production, not damaged
Antenna type	:	Internal Helical Antenna Max Gain 3.36 dBi
Frequency Range	:	2403 ~ 2481 MHz
RF output power	:	Max 10.02 dBm – Conducted
Number of channels	:	16
Duty cycle	:	43.89 %
Channel Access Protocol	:	Frequency Hopping Spread Spectrum (FHSS)
Type of Modulation	:	GFSK
Power Source	:	DC 3.7 V by battery
Firmware Version	:	V1.0.0

2-3 Tested frequency

FHSS	LOW	MID	HIGH
Frequency (MHz) –	2403	2440	2481

2-4 Ancillary Equipment

Equipment	Model No.	Serial No.	Manufacturer
Notebook	CR720	MS-1736	MSI

3. Test Report

3.1 Summary of tests

FCC Part Section(s)	Parameter	Limit	Test Condition	Status (note 1)
15.247(a)	Carrier Frequency Separation	≥ 2/3 of 20dB BW	Conducted	C
15.247(a)	Number of Hopping Frequencies	≥ 15 channels		C
15.247(a)	20 dB Bandwidth 99% Bandwidth	–		C
15.247(a)	Dwell Time	≤ 0.4 seconds		C
15.247(b)	Transmitter Output Power	≤ 1W for 1Mbps ≤ 125mW for 2,3Mbps		C
15.247(d)	Conducted Spurious emission	> 20 dBc		C
15.247(d)	Band Edge	> 20 dBc		C
15.249 / 15.209	Field Strength of Harmonics	< 54 dBuV (at 3m)	Radiated	C
15.109	Field Strength	–		C
15.207 /15.107	AC Conducted Emissions	EN 55022	Line Conducted	N/A
15.203	Antenna requirement	–	–	C

Note 1: C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable

Note 2: The data in this test report are traceable to the national or international standards.

Note 1: Antenna Requirement

→ The unit complies with the requirement of §15.203.

The antenna type is Helical Antenna.

The sample was tested according to the following specification:

*FCC Parts 15.247; ANSI C-63.4-2014;ANSI C-63.10-2013
*FCC KDB Publication No. 558074 D01 v03r05
*FCC TCB Workshop 2012, April

3.2 Frequency Hopping System Requirements

3.2.1 Standard Applicable

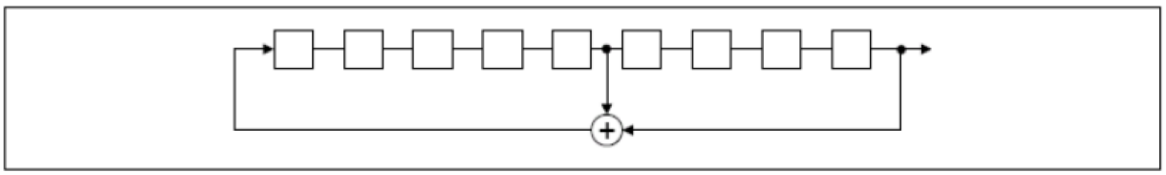
According to FCC Part 15.247(a)(1), The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

(g) Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

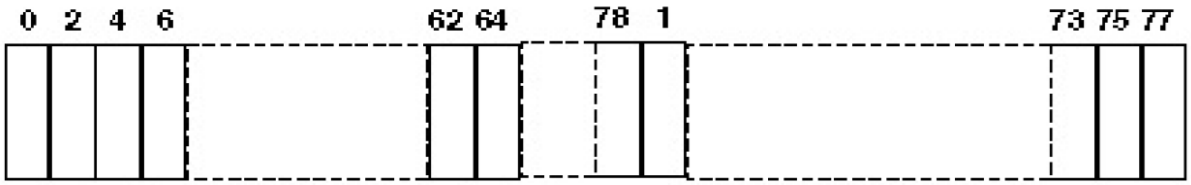
(h) The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

3.2.2 EUT Pseudorandom Frequency Hopping Sequence

The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage, and the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONEs; i.e. the shift register is initialized with nine ones. Number of shift register stages: 9
Length of pseudo-random sequence: 29-1 = 511 bits
Longest sequence of zeros: 8 (non-inverted signal)



Linear Feedback Shift Register for Generation of the PRBS sequence



Each frequency used equally on the average by each transmitter.
The system receiver have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

3.2.3 Frequency Hopping System

This transmitter device is frequency hopping device, and complies with FCC part 15.247 rule.

This device uses Bluetooth radio which operates in 2400-2483.5 MHz band. Bluetooth uses a radio technology called frequency-hopping spread spectrum, which chops up the data being sent and transmits chunks of it on up to 79 bands (1 MHz each; centred from 2402 to 2480 MHz) in the range 2,400-2,483.5 MHz. The transmitter switches hop frequencies 1,600 times per second to assure a high degree of data security. All Bluetooth devices participating in a given piconet are synchronized to the frequency-hopping channel for the piconet. The frequency hopping sequence is determined by the master's device address and the phase of the hopping sequence (the frequency to hop at a specific time) is determined by the master's internal clock. Therefore, all slaves in a piconet must know the master's device address and must synchronize their clocks with the master's clock.

Adaptive Frequency Hopping (AFH) was introduced in the Bluetooth specification to provide an effective way for a Bluetooth radio to counteract normal interference. AFH identifies "bad" channels, where either other wireless devices are interfering with the Bluetooth signal or the Bluetooth signal is interfering with another device. The AFH-enabled Bluetooth device will then communicate with other devices within its piconet to share details of any identified bad channels. The devices will then switch to alternative available "good" channels, away from the areas of interference, thus having no impact on the bandwidth used.

*Example for a Bluetooth device using channel numbers would be : Chan 44, 35, 78, 03, 15, 21, 76, 40, 56, 13, 02, 19, 67, 39, 78, 20, 21, 64, 75 etc.

3.3 TECHNICAL CHARACTERISTIC TEST

3.3.1 Carrier Frequency Separation

Procedure:

The test follows DA00-705. The carrier frequency separation was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled.

After the trace being stable, the reading value between the peaks of the adjacent channels using the marker-delta function was recorded as the measurement results.

The spectrum analyzer is set to:

Span = 2~ 3 MHz (wide enough to capture the peaks of two adjacent channels)

RBW = 10 kHz (1% of the span or more) Sweep = auto

VBW = 10 kHz Detector function = peak

Trace = max hold

Measurement Data:

Test Results	
Carrier Frequency Separation (MHz)	**Result**
4.023	Complies

- See next pages for actual measured spectrum plots.

Minimum Standard:

The EUT shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or two-thirds of 20 dB bandwidth of the hopping channel, whichever is greater.

Measurement Setup

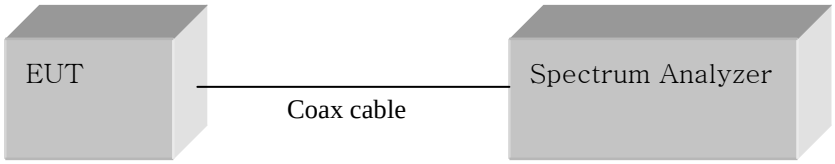
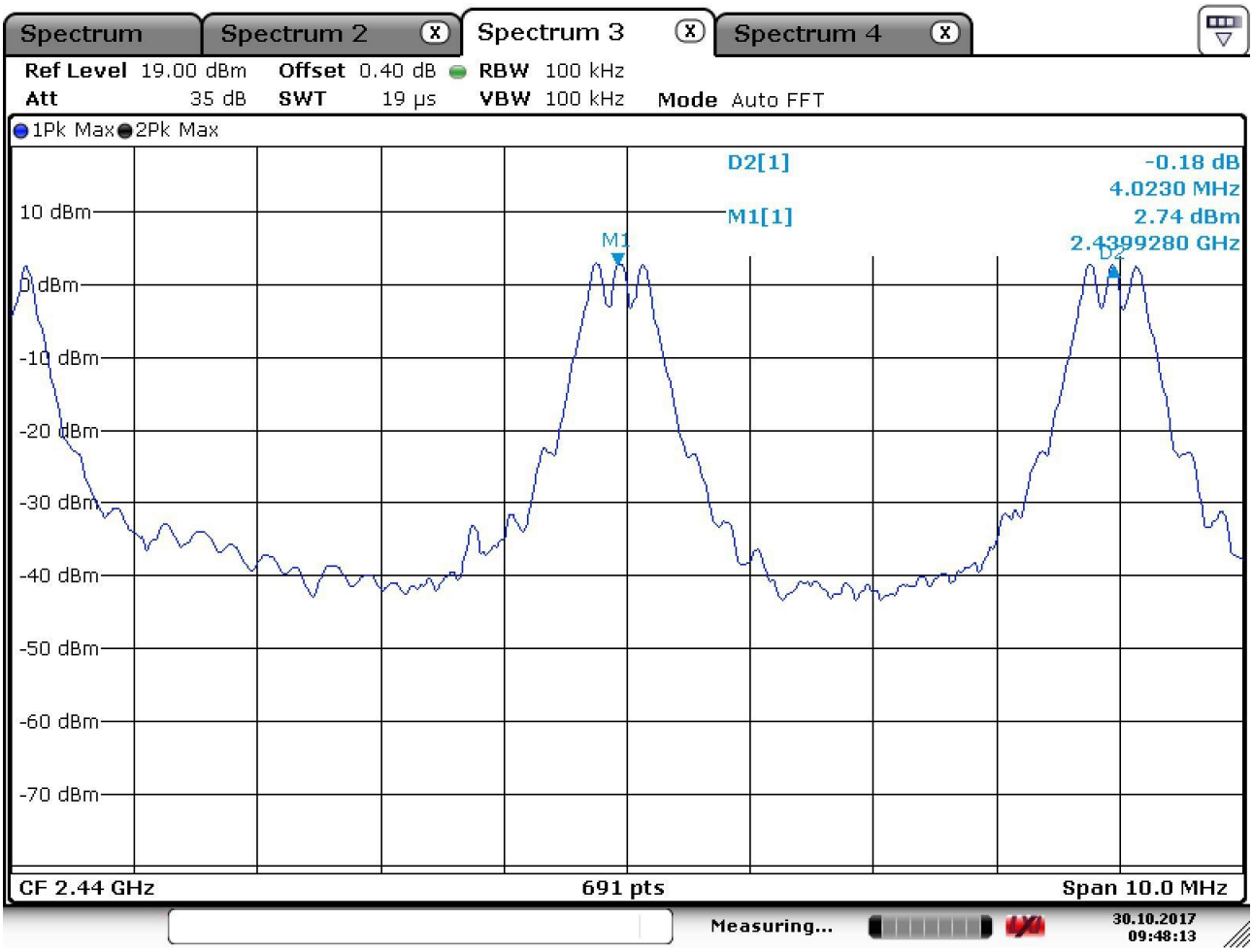


Figure 1: Measurement setup for the carrier frequency separation

Carrier Frequency Separation



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3.3.2 Number of Hopping Frequencies

Procedure:

The test follows DA00-705. The number of hopping frequencies was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled.

To get higher resolution, four frequency ranges within the 2400 ~ 2483.5 MHz FH band were examined.

The spectrum analyzer is set to (Bluetooth):

Frequency range Start = 2400.0 MHz, Stop = 2483.5 MHz

RBW = 100 kHz (1% of the span or more) Sweep = auto

VBW = 100 kHz (VBW ≥ RBW) Detector function = peak

Trace = max hold Span > 40 MHz

Measurement Data : Complies

Total number of Hopping Channels	40

- See next pages for actual measured spectrum plots.

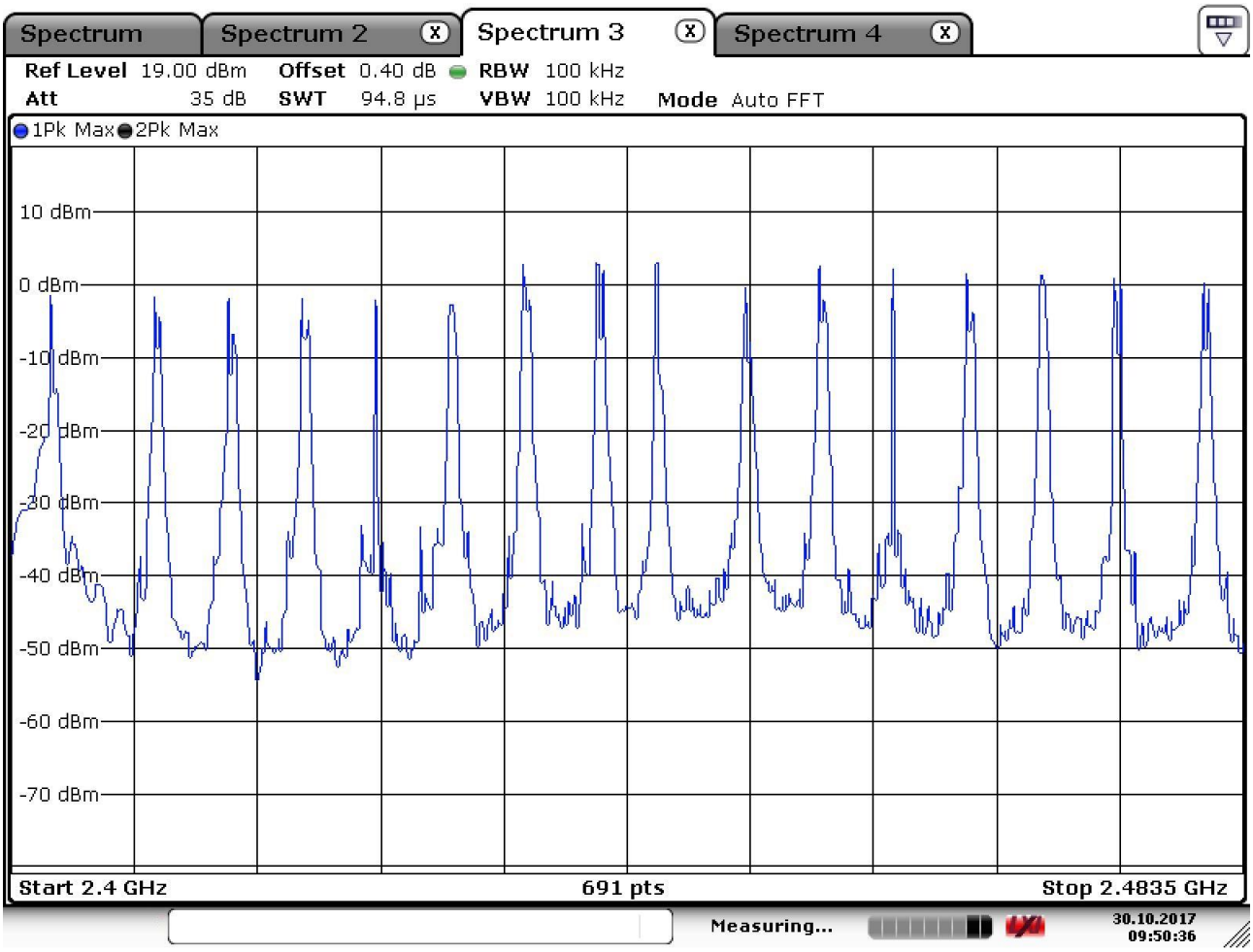
Minimum Standard:

At least 15 channels

Measurement Setup

Same as the Chapter 3.3.1 (Figure 1)

Number of Hopping Frequencies



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3.3.3 20 dB Bandwidth

Procedure:

The bandwidth at 20 dB below the highest inband spectral density was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function disabled at the highest, middle and the lowest available channels..

After the trace being stable, Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 20 dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 20 dB bandwidth of the emission.

The spectrum analyzer is set to (Bluetooth):

Center frequency = the highest, middle and the lowest channels

Span = 3 MHz (approximately 2 or 3 times of the 20 dB bandwidth)

RBW = 30 kHz Sweep = auto

VBW = 30 kHz (VBW ≥ RBW) Detector function = peak

Trace = max hold

Measurement Data: Complies

Frequency (MHz)	Channel No.	Test Results(MHz)	
		20dB Bandwidth	99% Bandwidth
2403	1	0.087	1.476
2440	8	0.087	1.389
2481	16	0.087	1.447

- See next pages for actual measured spectrum plots.

Minimum Standard:

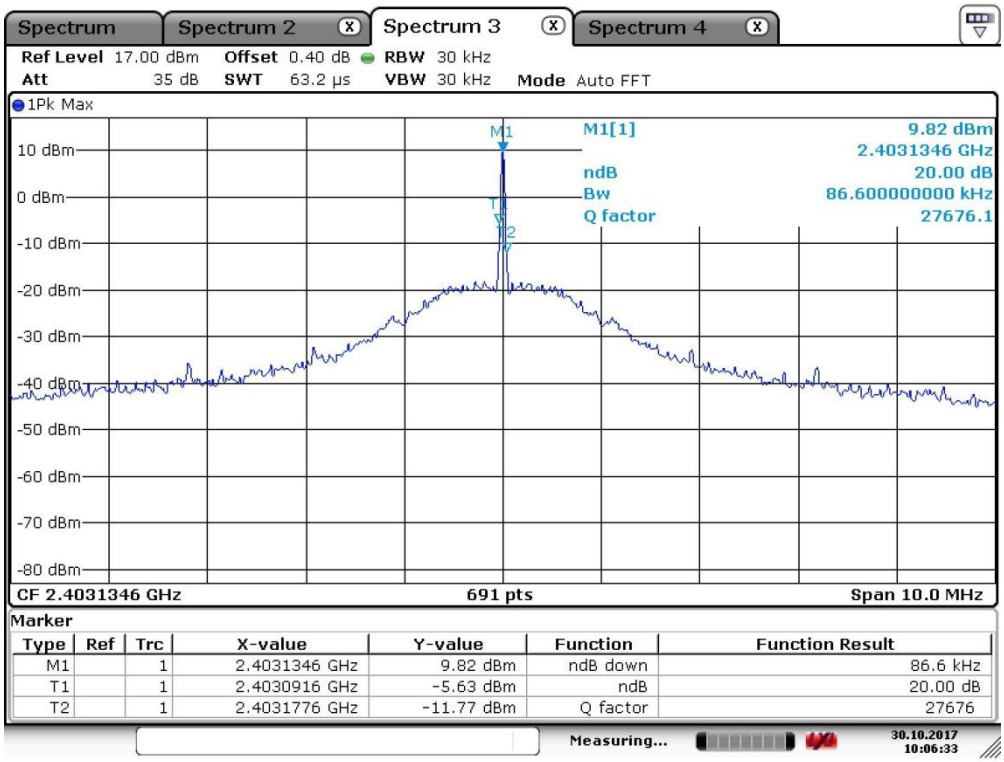
N/A

Measurement Setup

Same as the Chapter 3.3.1 (Figure 1)

Channel LOW

20 dB Bandwidth



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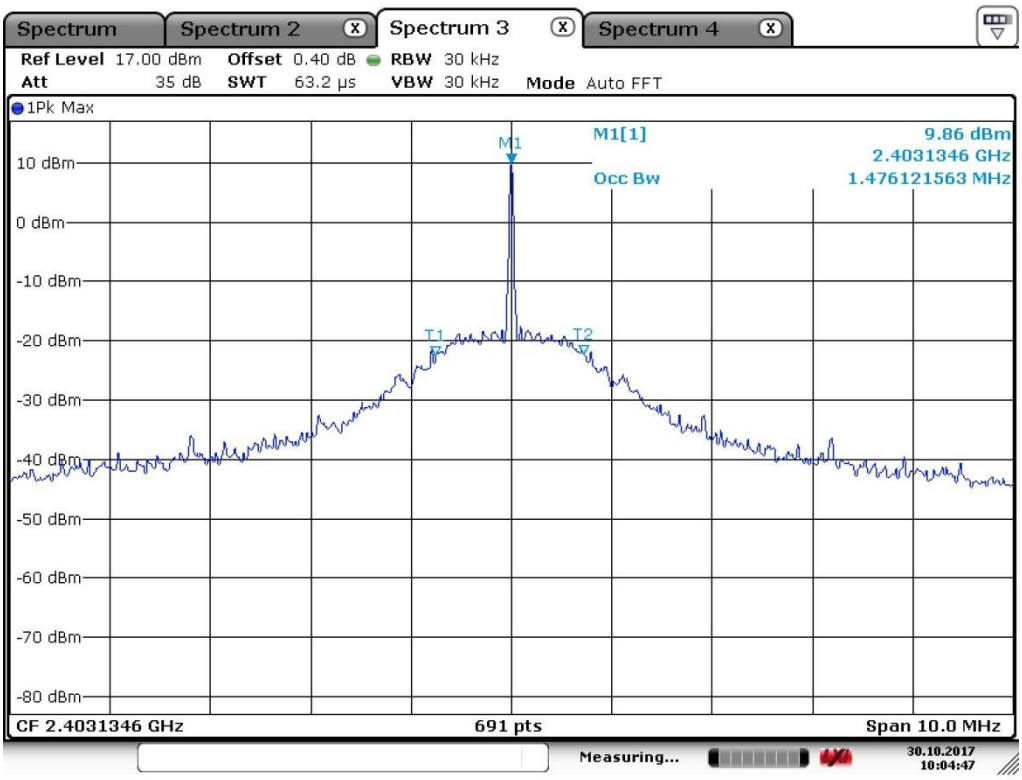
99% Bandwidth



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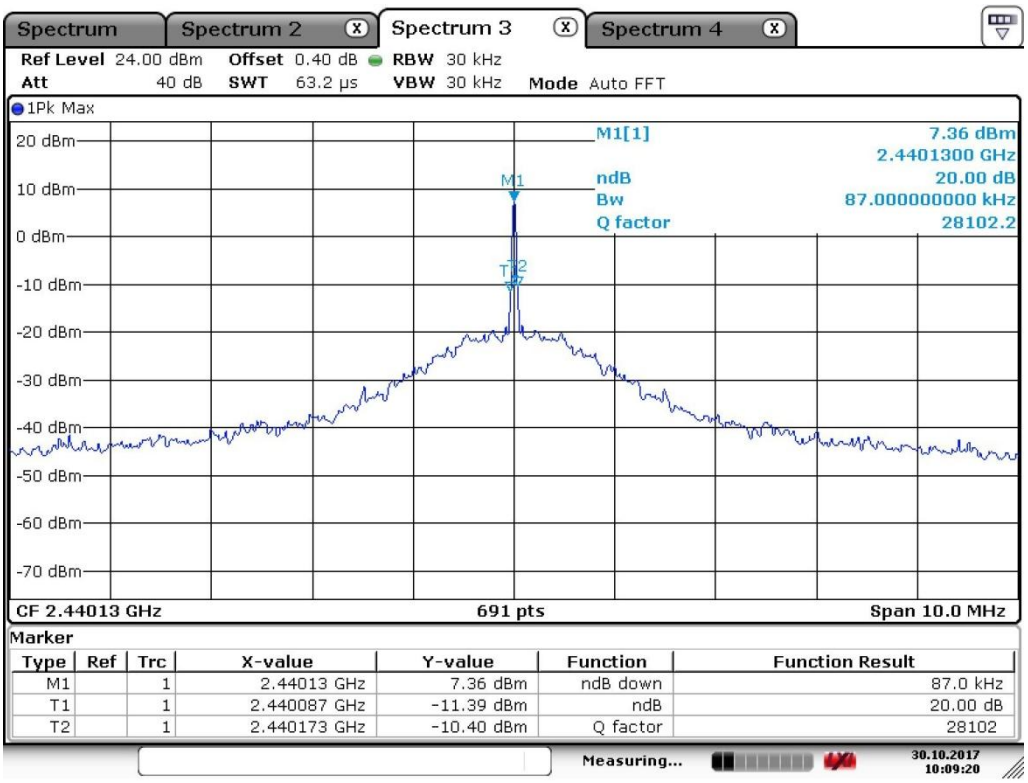
Channel MID

20 dB Bandwidth



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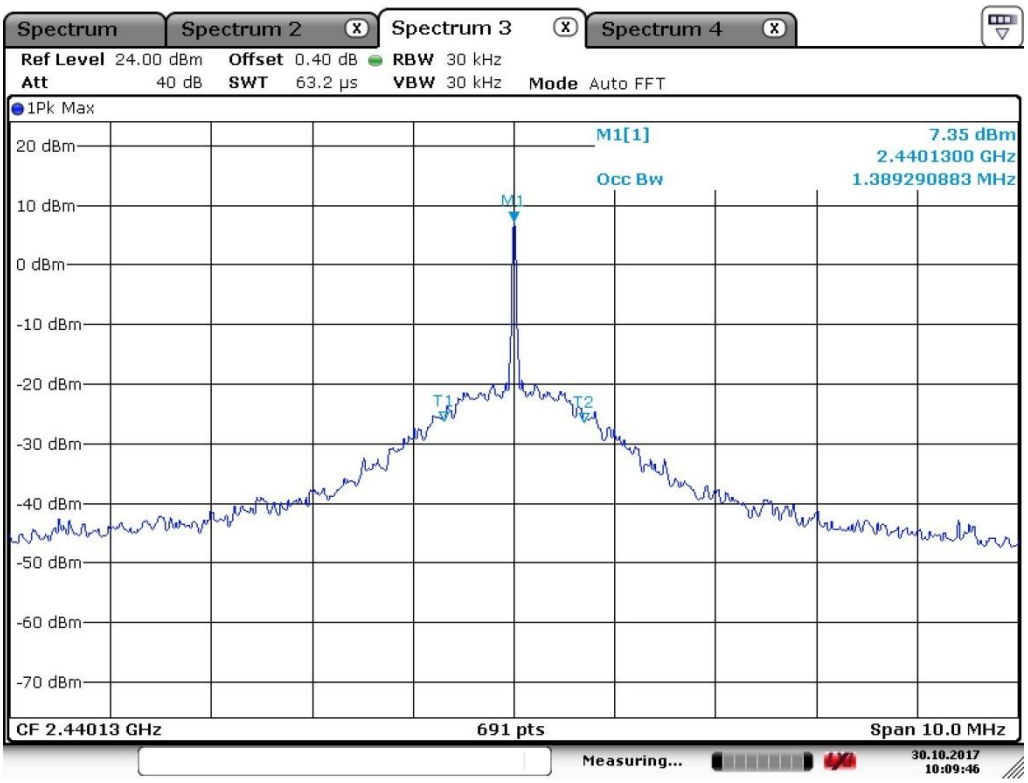
99% Bandwidth



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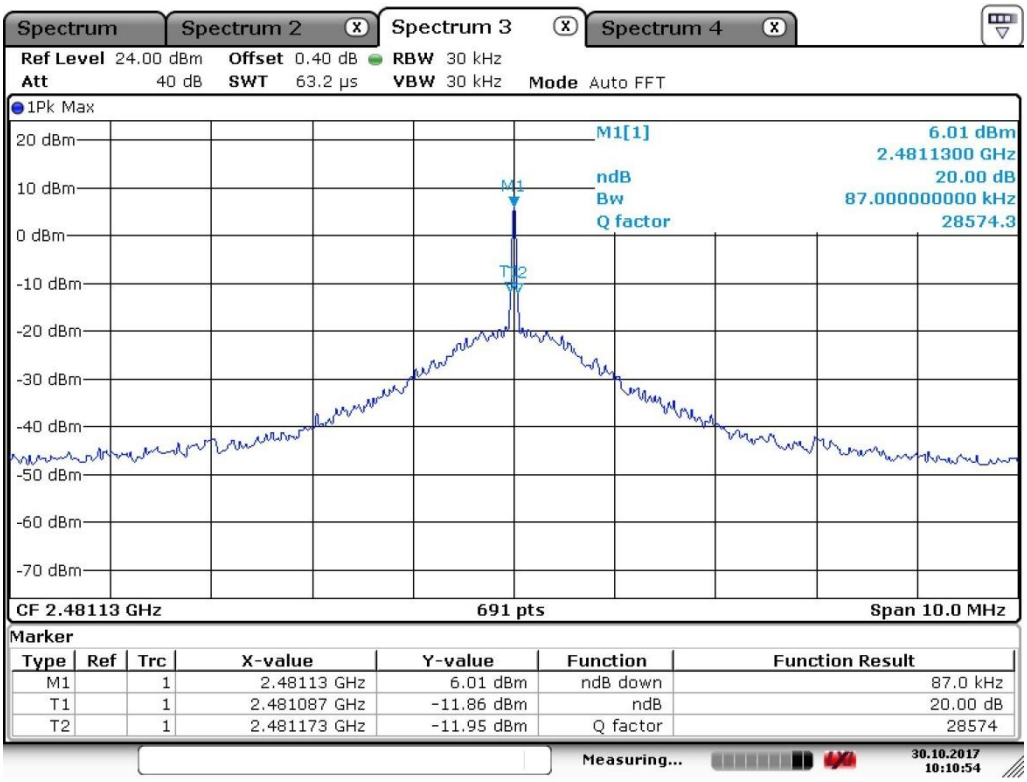
Channel HIGHe

20 dB Bandwidth



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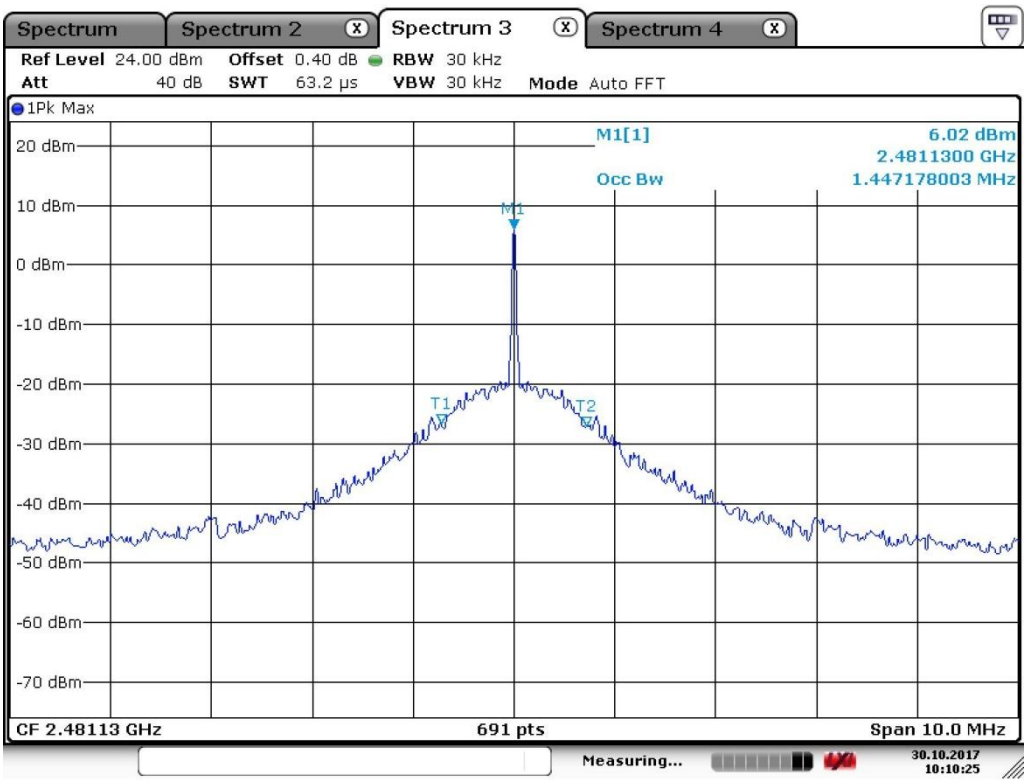
99% Bandwidth



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3.3.4 Time of Occupancy (Dwell Time)

Procedure:

The test follows DA00-705. The dwell time was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled.

The spectrum analyzer is set to :

Center frequency = 2441 MHz　　Span = zero

RBW = 1 MHz　　VBW = 1 MHz (VBW ≥ RBW)

Trace = max hold　　Detector function = peak

Measurement Data :

Mode	Number of transmission in a 6.4s (16Hopping*0.4)	Length of Transmission Time (msec)	Result (msec)	Limit (msec)
FHSS	**8(Times / 3sec) *2.13 = 17.04**	**1.782**	**30.36**	**400**

- See next pages for actual measured spectrum plots.
- dwell time = {(number of hopping per second / number of slot) x duration time per channel} x 0.4 ms

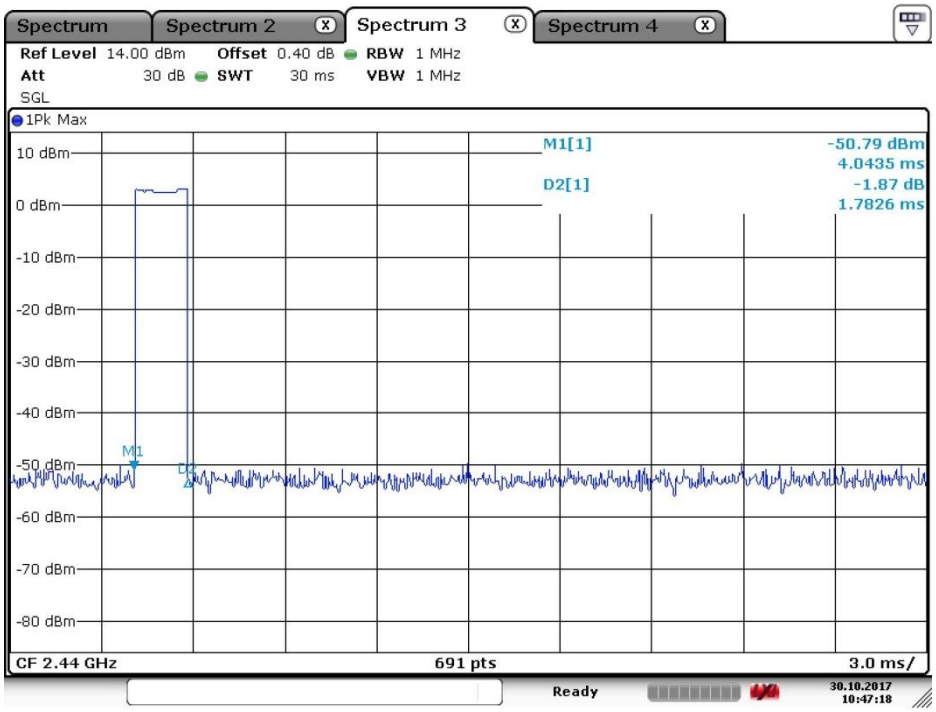
Minimum Standard:

0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed

Measurement Setup

Same as the Chapter 3.3.1 (Figure 1)

FHSS



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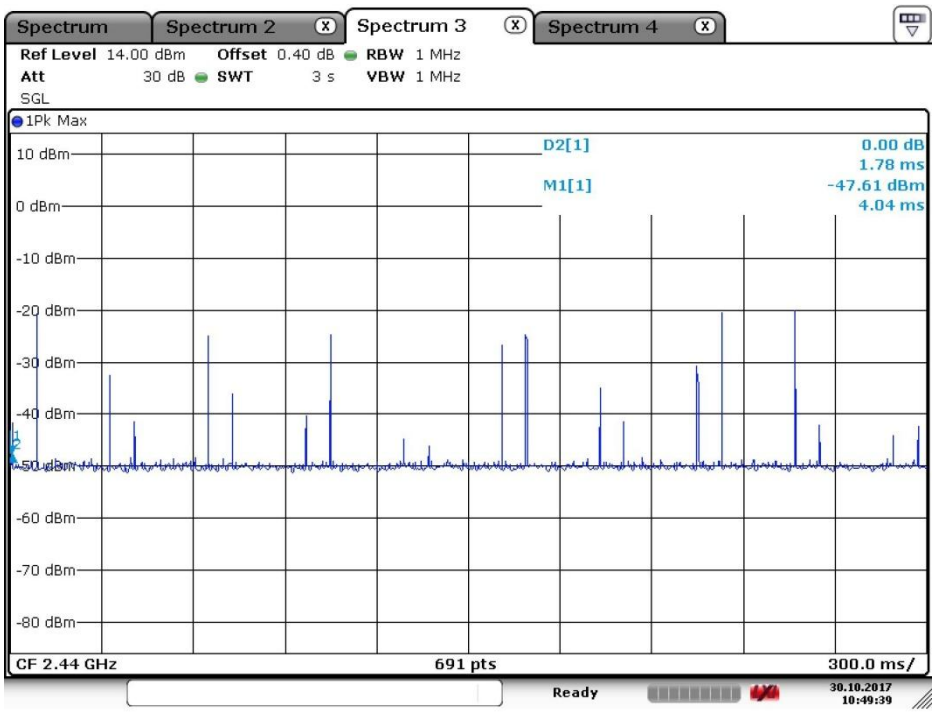

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3.3.5 Transmitter Output Power

Procedure:

The test follows DA00-705. The peak output power was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function disabled at the highest, middle and the lowest available channels..

After the trace being stable, Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power.

The spectrum analyzer is set to :

Center frequency = the highest, middle and the lowest channels

Span = 10 MHz (approximately 5 times of the 20 dB bandwidth)

RBW = 3 MHz (greater than the 20 dB bandwidth of the emission being measured)

VBW = 3 MHz (VBW ≥ RBW) Detector function = peak

Trace = max hold Sweep = auto

Measurement Data :

Frequency (MHz)	Ch.	Test Results				
		Peak Output Power		Average Power		Result
		dBm	mW	dBm	mW	
2403	1	**10.02**	**10.04**	**-24.96**	**0.003**	Complies
2440	8	**7.44**	**5.54**	**-27.54**	**0.002**	Complies
2481	16	**6.14**	**4.11**	**-28.84**	**0.001**	Complies

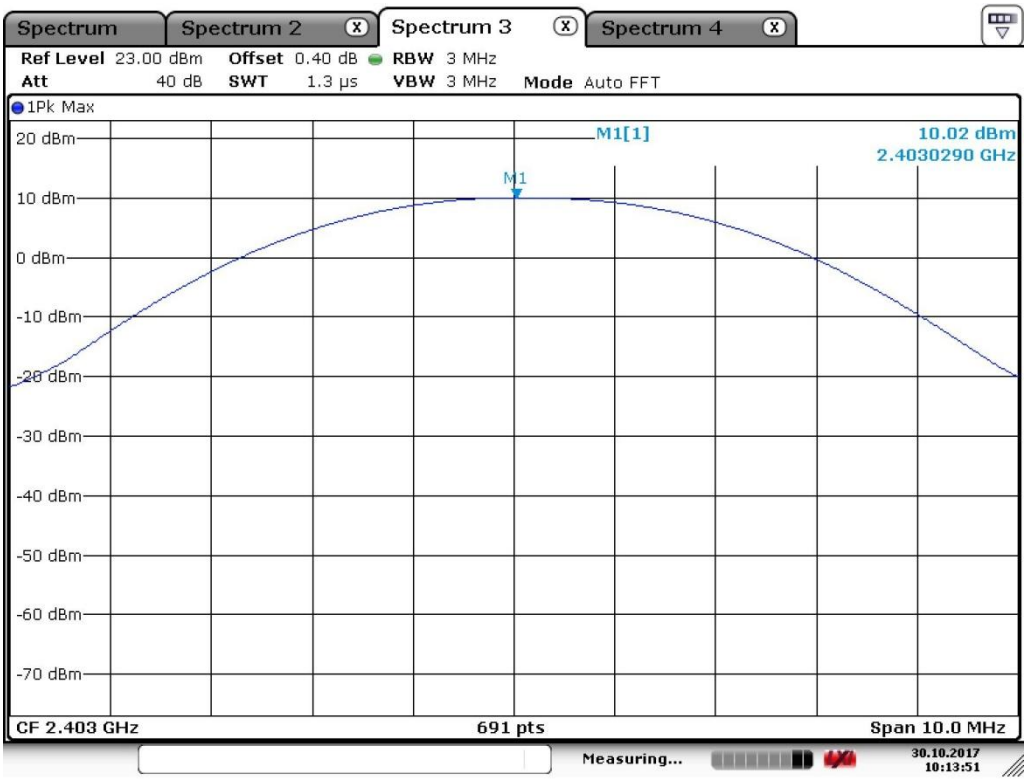
- See next pages for actual measured spectrum plots.
- Average Power = Peak Output Power – Duty Cycle Correction Factor

Minimum Standard:	For frequency hopping systems with at least 75 non-overlapping hopping channels: 1 watt. For all other frequency hopping systems: 0.125 W.

Measurement Setup

Same as the Chapter 3.3.1 (Figure 1)

Channel LOW



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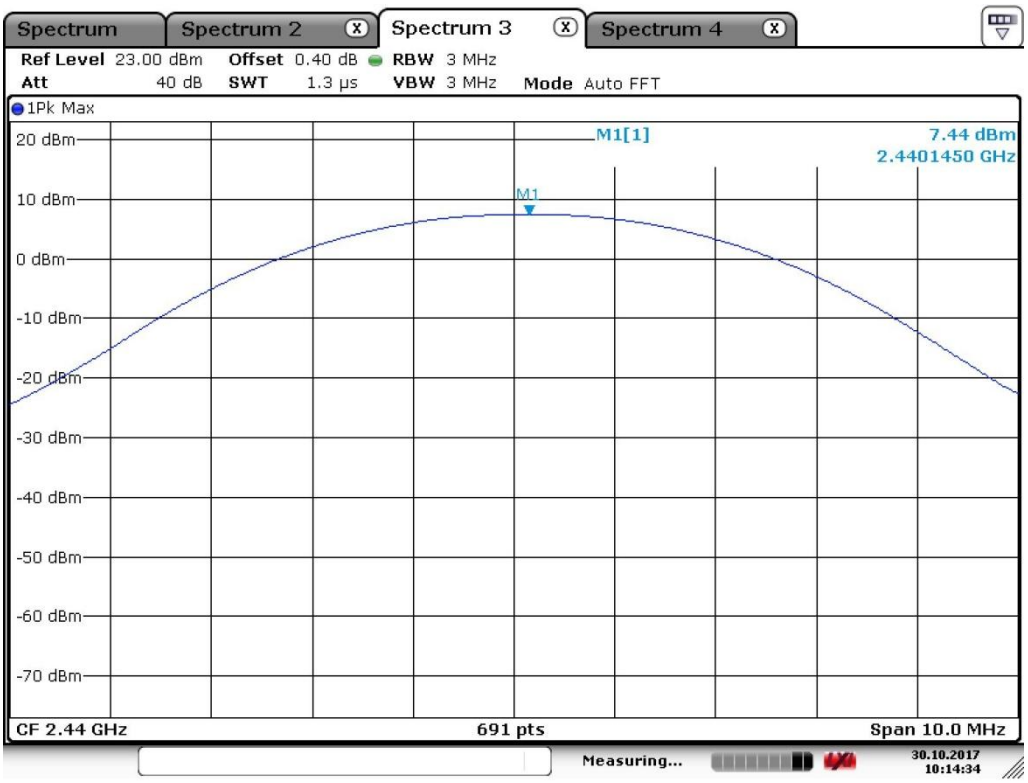
Channel MID



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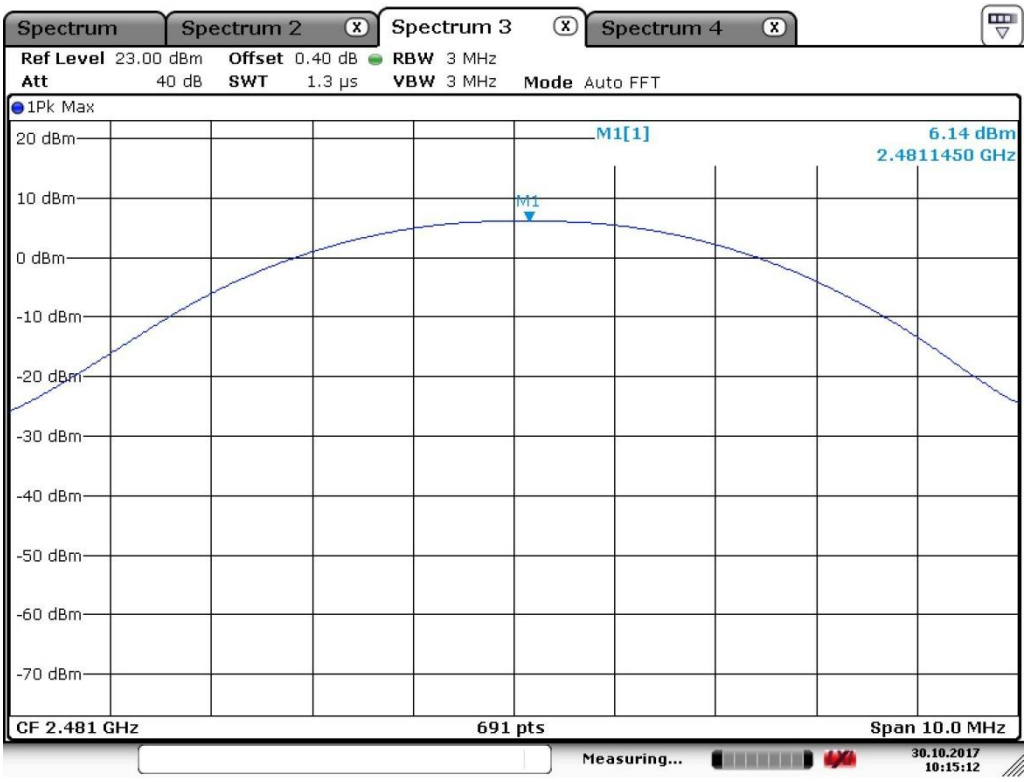
Channel HIGH



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3.3.6 Band Edge

Procedure:

The bandwidth at 20 dB down from the highest inband spectral density is measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function disabled at the highest, middle and the lowest available channels.

After the trace being stable, Use the marker-to-peak function to measure 20 dB down both sides of the intentional emission.

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

RBW = 100 kHz	VBW = 100 kHz
Span = 10~30 MHz	Detector function = peak
Trace = max hold	Sweep = auto

Measurement Data: **Complies**

- All conducted emission in any 100 kHz bandwidth outside of the spread spectrum band was at least 20 dB lower than the highest inband spectral density. Therefore the applying equipment meets the requirement.
- See next pages for actual measured spectrum plots.

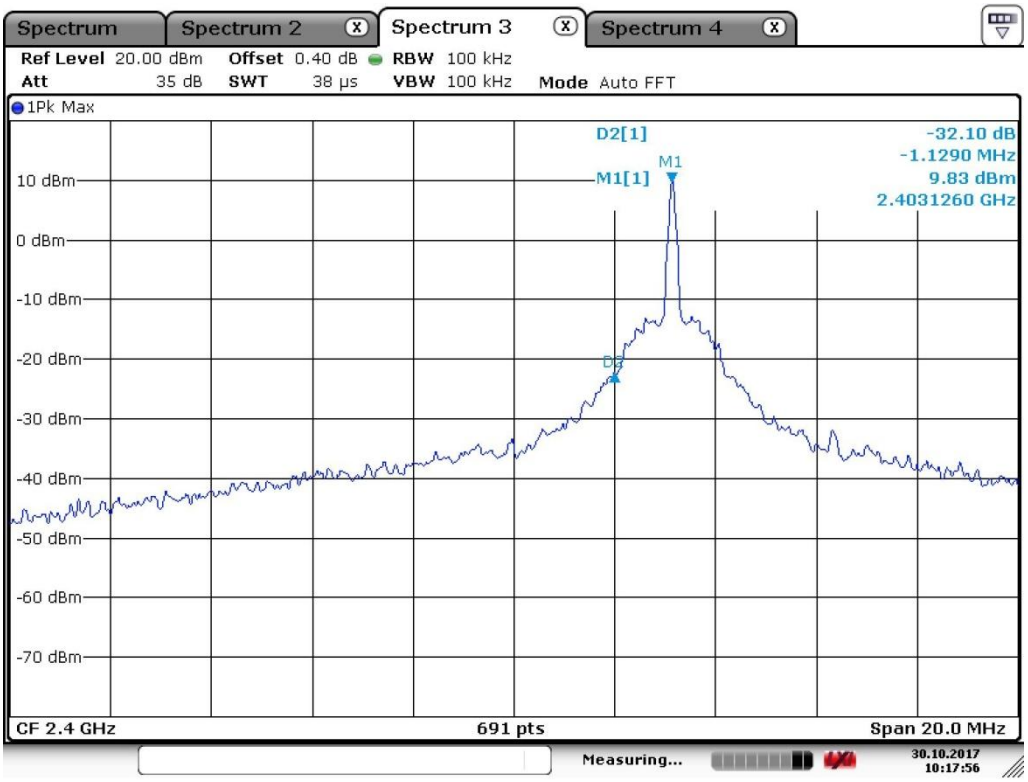
Minimum Standard:	> 20 dBc

Measurement Setup

Same as the Chapter 3.3.1 (Figure 1)

Band Edge

Lower edge



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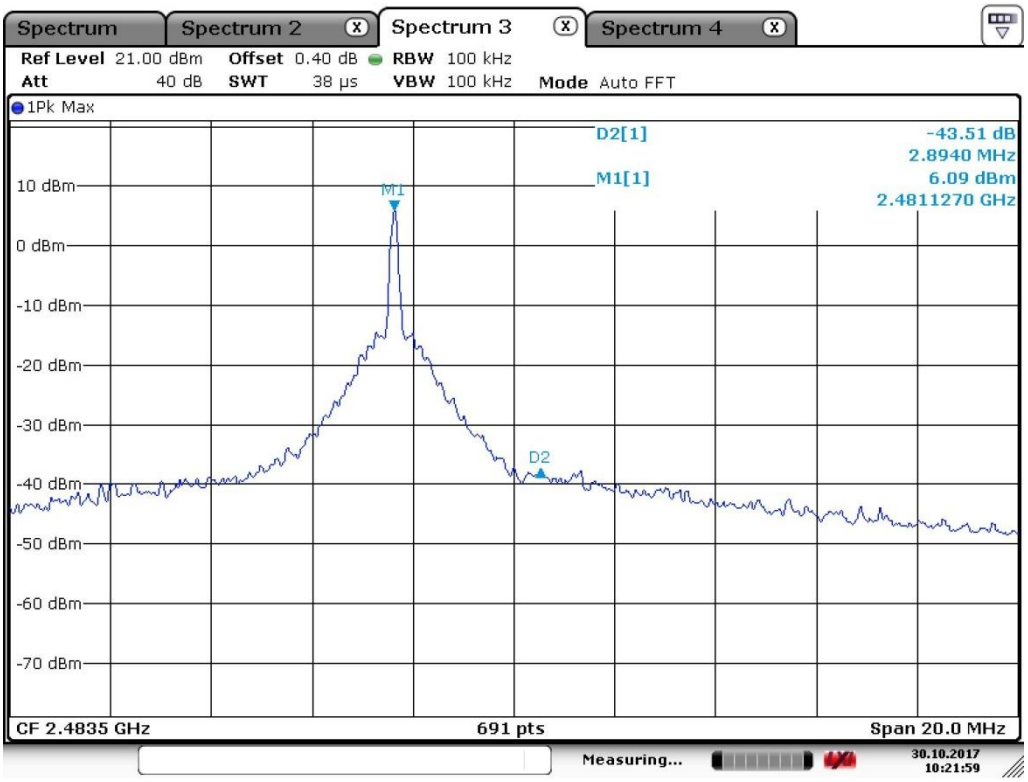
Upper edge



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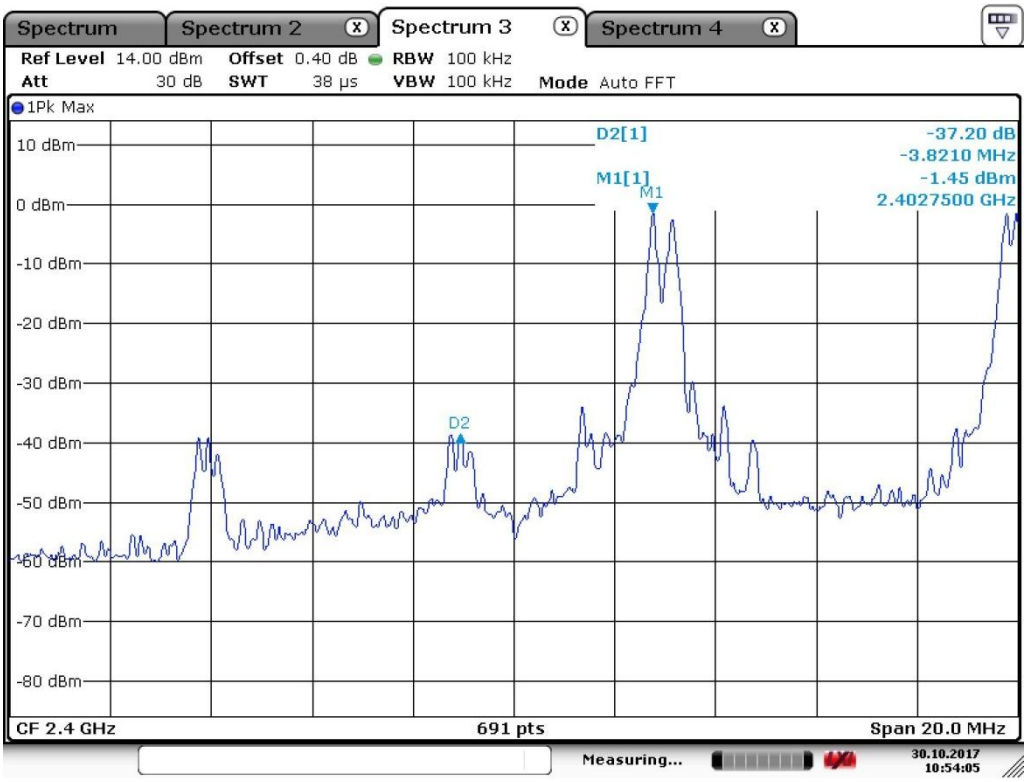
Band Edge- Hopping

Lower edge



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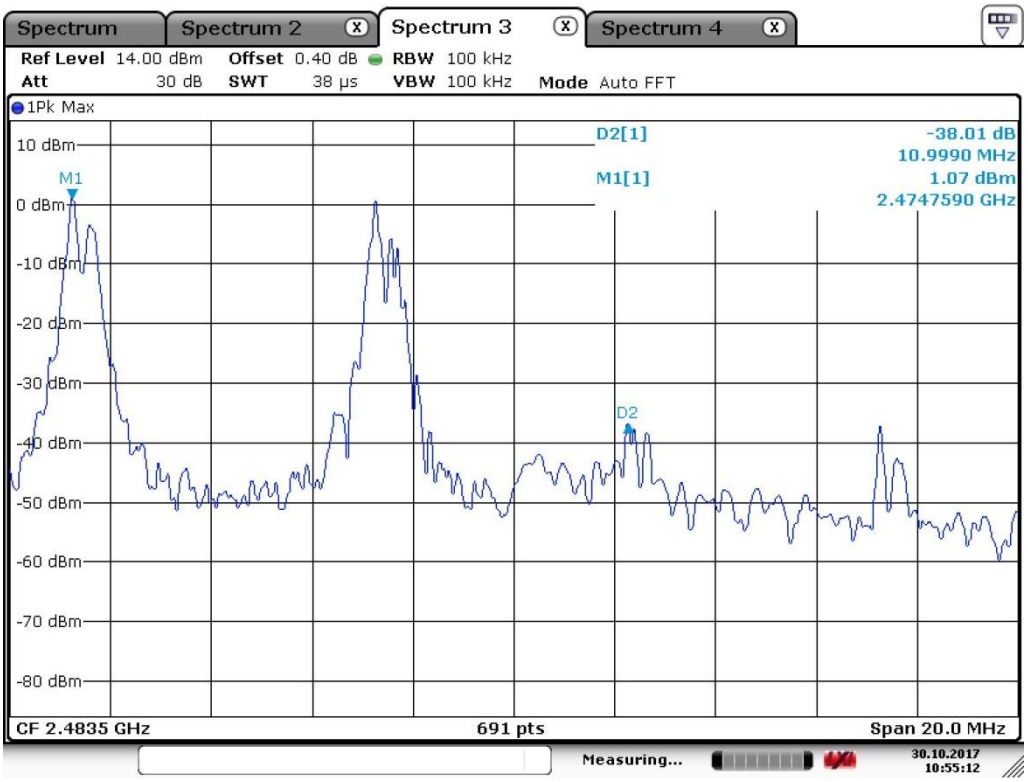
Upper edge



Date: 30.OCT.2017 10:55:12

Radiated Band edges in the restricted band 2310-2390 MHz measurement

Frequency [MHz]	Reading [dBuV/m] AV / Peak		Pol.	Correction Factor		Limits [dBuV/m] AV / Peak		Result [dBuV/m] AV / Peak		Margin [dB] AV / Peak	
				Antenna	Amp. Gain+CableLoss						
2312.1	28.30	41.18	V	28.08	22.9	54.0	74.0	33.48	46.36	20.52	27.64
2311.5	29.44	40.08	V	28.09	22.9	54.0	74.0	34.62	45.26	19.38	28.74
2328.9	28.58	40.11	V	28.09	22.9	54.0	74.0	33.76	45.29	20.24	28.71

Radiated Band edges in the restricted band 2483.5-2500 MHz measurement

Frequency [MHz]	Reading [dBuV/m] AV / Peak		Pol.	Correction Factor		Limits [dBuV/m] AV / Peak		Result [dBuV/m] AV / Peak		Margin [dB] [MHz]	
				Antenna	Amp. Gain+CableLoss						
2485.2	27.35	40.12	V	28.08	22.9	54.0	74.0	32.53	45.3	21.47	28.7
2486.7	28.07	40.94	V	28.09	22.9	54.0	74.0	33.25	46.12	20.75	27.88
2486.2	28.01	40.50	V	28.09	22.9	54.0	74.0	33.19	45.68	20.81	28.32

Note : This EUT was tested in 3 orthogonal positions and the worst-case data was presented.

3.3.7 Conducted Spurious Emissions

Procedure:

The test follows DA00-705. The conducted spurious emissions were measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function disabled at the highest, middle and the lowest available channels..

After the trace being stable, set the marker on the peak of any spurious emission recorded.

The spectrum analyzer is set to:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions

RBW = 100 kHz Sweep = auto

VBW = 100 kHz Detector function = peak

Trace = max hold

Measurement Data: **Complies**

- All conducted emission in any 100 kHz bandwidth outside of the spread spectrum band was at least 20 dB lower than the highest inband spectral density. Therefore the applying equipment meets the requirement.
- See next pages for actual measured spectrum plots.

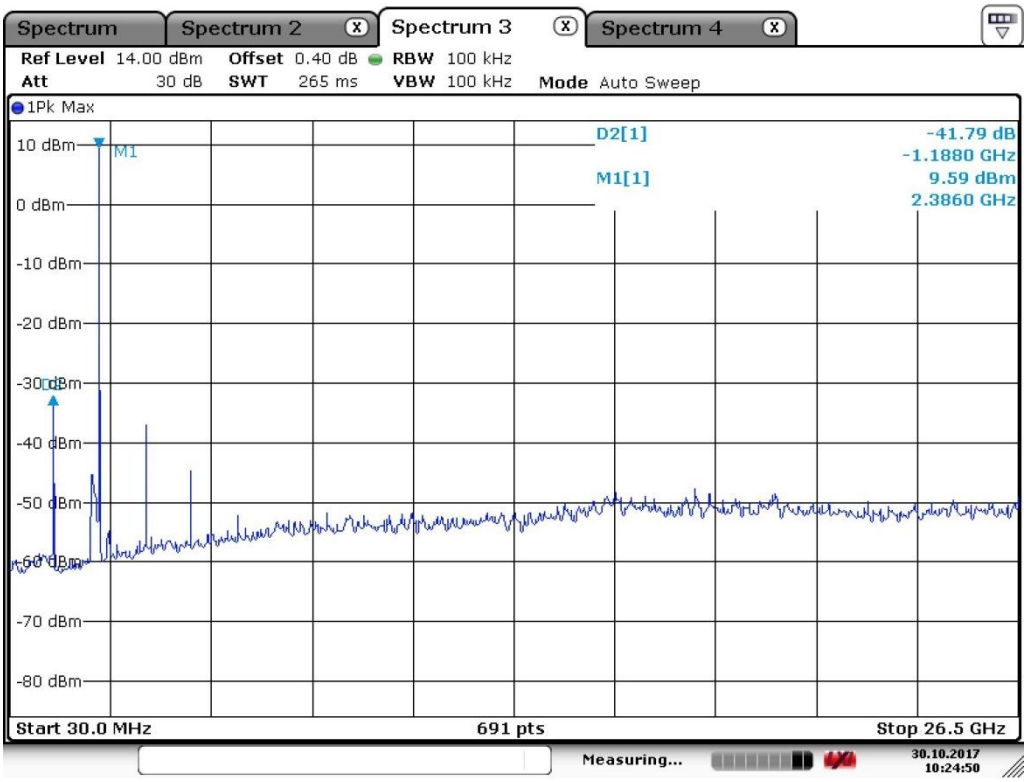
Minimum Standard:	> 20 dBc

Measurement Setup

Same as the Chapter 3.3.1 (Figure 1)

Unwanted Emission – Channel LOW

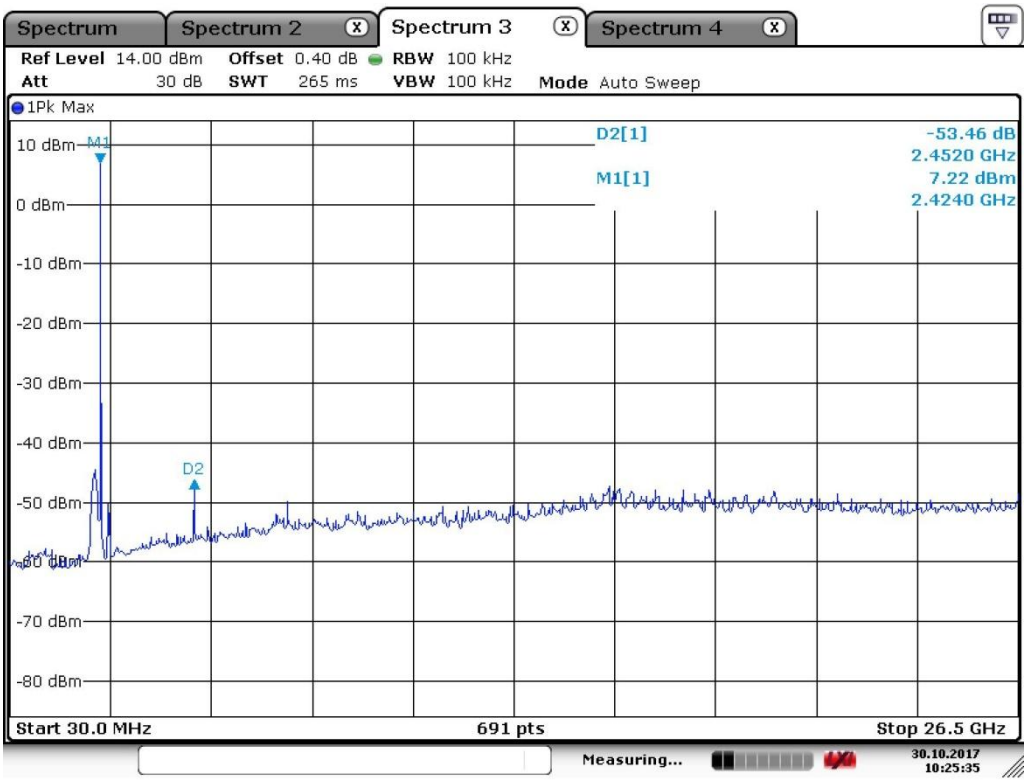
Frequency Range = 30 MHz ~ 26.5 GHz



Date: 30.OCT.2017 10:24:50

Unwanted Emission – Channel Middle

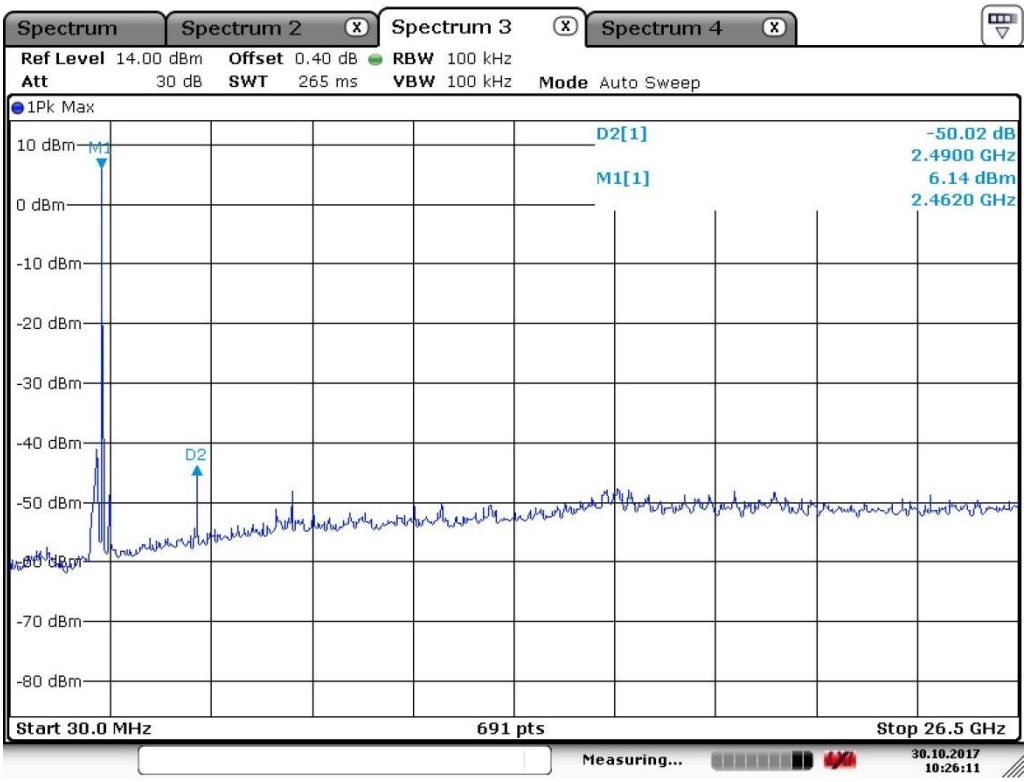
Frequency Range = 30 MHz ~ 26.5 GHz



Date: 30.OCT.2017 10:25:36

Unwanted Emission – High channel

Frequency Range = 30 MHz ~ 26.5 GHz



Date: 30.OCT.2017 10:26:11

3.3.8 Radiated Spurious Emissions

Procedure:

Radiated emissions from the EUT were measured according to the dictates of DA00-705. The EUT was placed on a 0.8 m high wooden table inside a shielded enclosure. An antenna was placed near the EUT and measurements of frequencies and amplitudes of field strengths were recorded for reference during final measurements. For final radiated testing, measurements were performed in OATS. Measurements were performed with the EUT oriented in 3 orthogonal axis and rotated 360 degrees to determine worst-case orientation for maximum emissions.

(a) In the frequency range of 9 kHz to 30 MHz, magnetic field is measured with Loop Test Antenna. The Test Antenna is positioned with its plane vertical at 3 m distance from the EUT. The center of the Loop Test Antenna is 1m above the ground. During the measurement the Loop Test Antenna rotates about its vertical axis for maximum response at each azimuth about the EUT.

(b) In the frequency range above 30 MHz, Bi-Log Test Antenna (30 MHz to 1 GHz) and Horn Test Antenna (above 1 GHz) are used. Test Antenna is 3 m away from the EUT. Test Antenna height is carried from 1 m to 4m above the ground to determine the maximum value of the field strength. The emission levels at both horizontal and vertical polarizations should be tested.

The spectrum analyzer is set to:

Center frequency = the worst channel

Frequency Range = 9 kHz ~ 10^{th} harmonic.

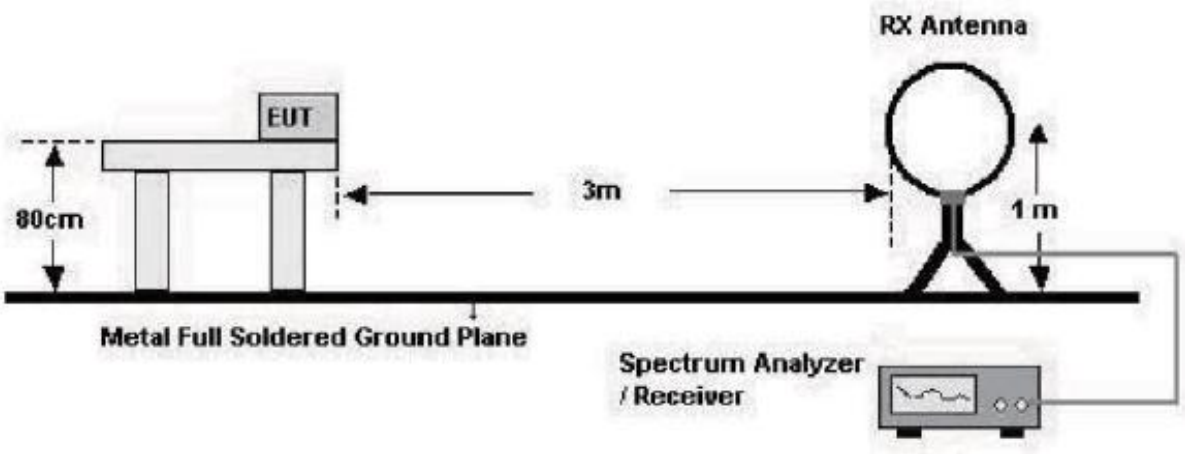
RBW = 120 kHz (30 MHz ~ 1 GHz) VBW ≥ RBW

= 1 MHz (1 GHz ~ 10^{th} harmonic)

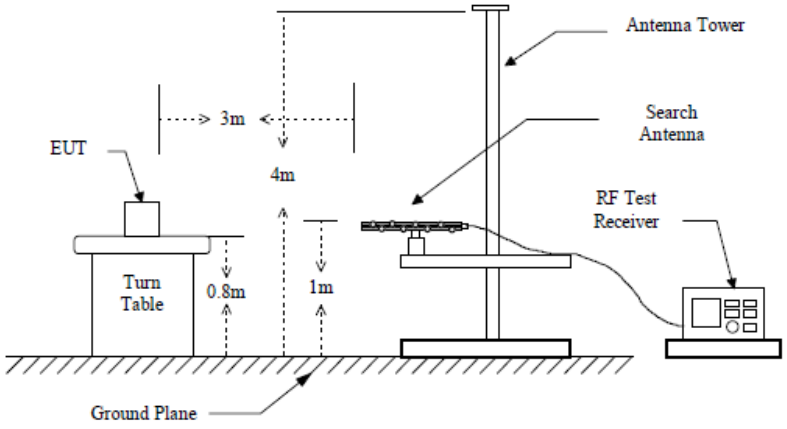
Span = 100 MHz Detector function = peak

Trace = max hold Sweep = auto

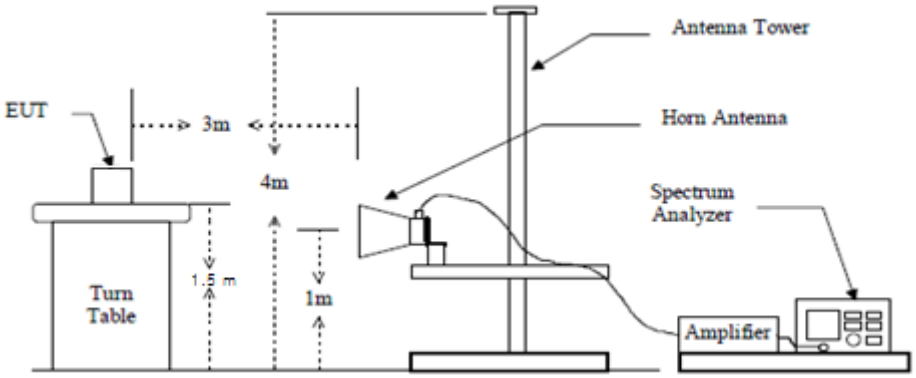
below 30 MHz



below 1 GHz (30 MHz to 1 GHz)



above 1 GHz



Measurement Data: **Complies**

- See next pages for actual measured data.
- No other emissions were detected at a level greater than 20 dB below limit include from 9 kHz to 30 MHz.

Minimum Standard: FCC Part 15.209(a)

Frequency (MHz)	Limit (uV/m) @ 3m
0.009 ~ 0.490	2400/F(kHz) **(@ 300m)**
0.490 ~ 1.705	24000/F(kHz) **(@ 30m)**
1.705 ~ 30	30**(@ 30m)**
30 ~ 88	100 **
88 ~ 216	150 **
216 ~ 960	200 **
Above 960	500

** Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.

Measurement Data : FHSS

Frequency [MHz]	Reading [dBuV/m] AV / Peak		Pol.	Correction Factor Antenna+(Cable-Amp.Gain)	D.C.F	Limits [dBuV/m] AV/Peak		Result [dBuV/m] AV/Peak		Margin [dB] AV / Peak	
7544.70	35.7	45.1	V	26.71	-34.98	54.0	74.0	27.43	36.83	26.57	37.17
7597.61	35.5	43.9	V	26.71	-34.98	54.0	74.0	27.23	35.63	26.77	38.37
7638.12	34.5	46.7	V	26.71	-34.98	54.0	74.0	26.23	38.43	27.77	35.57

- No other emissions were detected at a level greater than 20dB below limit.

- D.C.F (Duty Cycle Correction Factor) = 20log(The worst Case DWELL Time/100ms)

= 20log(1.782ms/100ms) = -34.98

Radiated Emissions – (below 1GHz)

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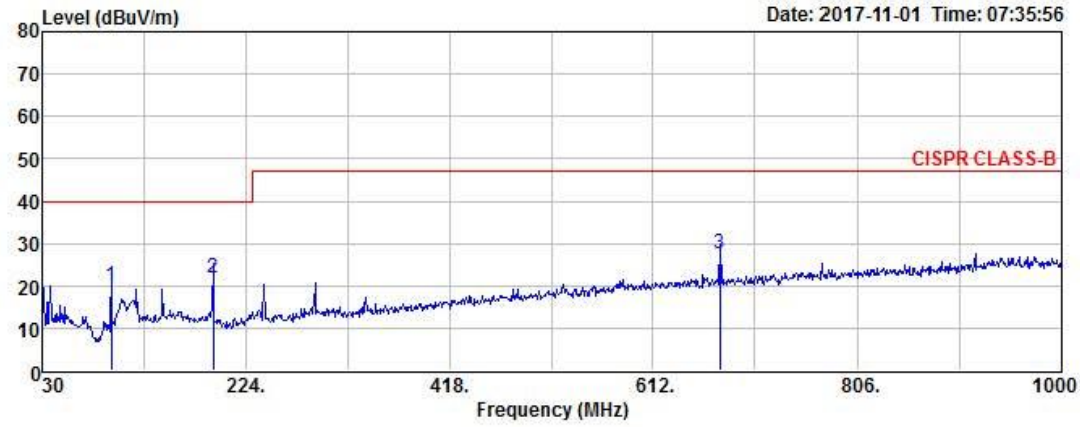
EUT/Model No.: SH-350G Temp/Humi: 23 / 40

Test Mode : Wireless mode(LOW) Tested by: BANG Y H

Data: 1780 File: C:\Program Files (x86)\e3\1710-1.EM6 (1780)



Freq	Reading	C.F	Result QP	Limit	Margin	Height	Angle	Polarity
MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	deg	
95.96	38.73	-18.66	20.07	40.00	19.93	325	16	HORIZONTAL
192.96	38.33	-16.61	21.72	40.00	18.28	338	151	HORIZONTAL
676.02	34.80	-7.27	27.53	47.00	19.47	378	44	HORIZONTAL

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain

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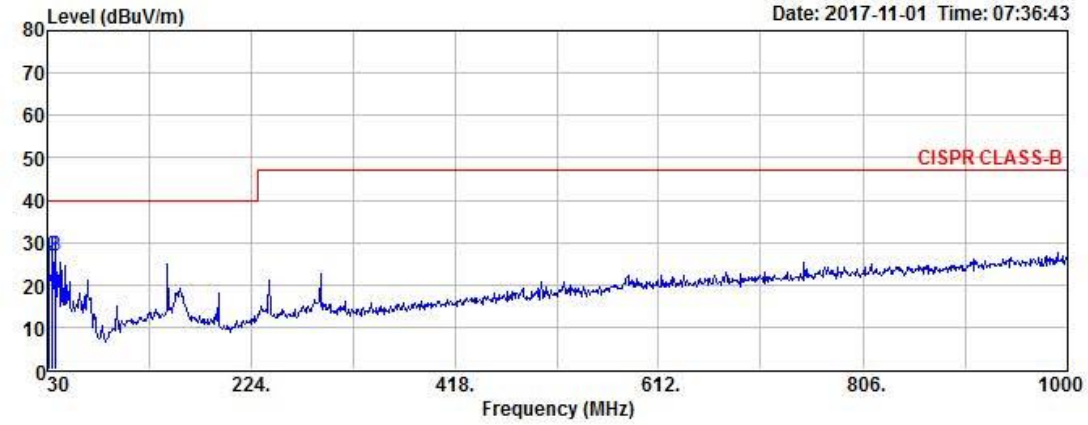
EUT/Model No.: SH-350G Temp/Humi: 23 / 40

Test Mode : Wireless mode(LOW) Tested by: BANG Y H

Data: 1779 File: C:\Program Files (x86)\e3\1710-1.EM6 (1780)



Freq	Reading	C.F	Result QP	Limit	Margin	Height	Angle	Polarity
MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	deg	
30.97	42.49	-15.93	26.56	40.00	13.44	100	32	VERTICAL
34.85	42.56	-15.61	26.95	40.00	13.05	115	131	VERTICAL
37.76	42.18	-15.36	26.82	40.00	13.18	100	325	VERTICAL

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain

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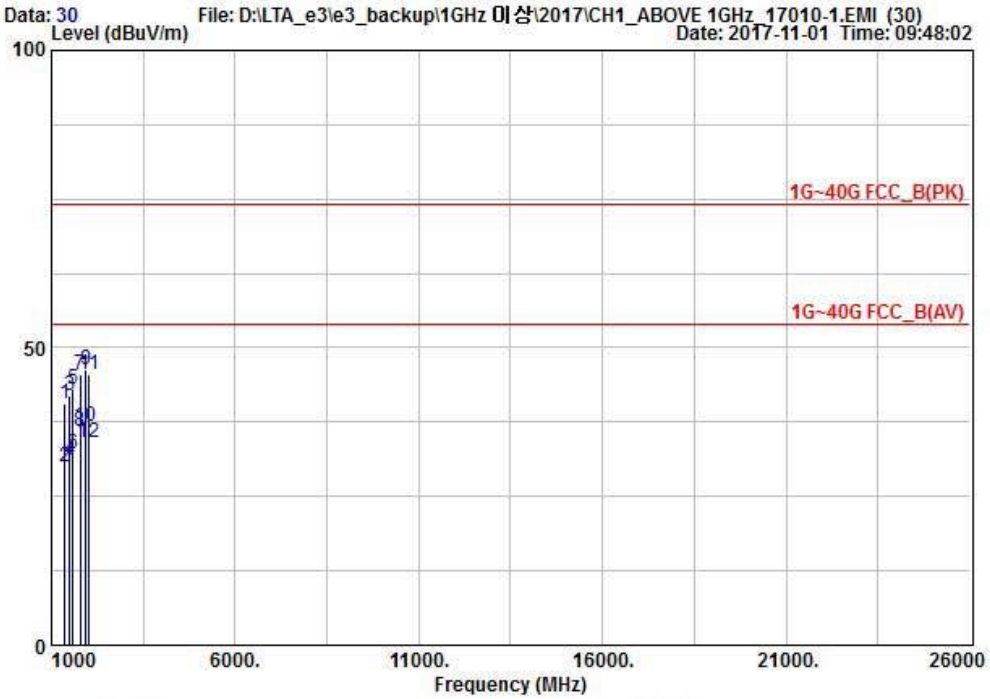
EUT/Model No.: SH-350G Test Mode: Wireless mode(LOW)
Tested by : BANG Y H Temp/Humi: 22 / 43



	Freq	Reading	C.F	Result PK	Limit	Margin	Polarity
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	1358.70	45.50	-4.81	40.69	74.00	33.31	VERTICAL
2	1358.70	34.90	-4.81	30.09	54.00	23.91	VERTICAL
3	1498.60	45.40	-3.53	41.87	74.00	32.13	VERTICAL
4	1498.60	34.70	-3.53	31.17	54.00	22.83	VERTICAL
5	1578.20	45.80	-2.86	42.94	74.00	31.06	VERTICAL
6	1578.20	35.10	-2.86	32.24	54.00	21.76	VERTICAL
7	1788.40	45.90	-0.28	45.62	74.00	28.38	VERTICAL
8	1788.40	36.20	-0.28	35.92	54.00	18.08	VERTICAL
9	1939.70	45.10	1.19	46.29	74.00	27.71	VERTICAL
10	1939.70	35.70	1.19	36.89	54.00	17.11	VERTICAL
11	2019.20	43.70	1.68	45.38	74.00	28.62	VERTICAL
12	2019.20	32.50	1.68	34.18	54.00	19.82	VERTICAL

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain
Blue : Vertical Black : Horizontal

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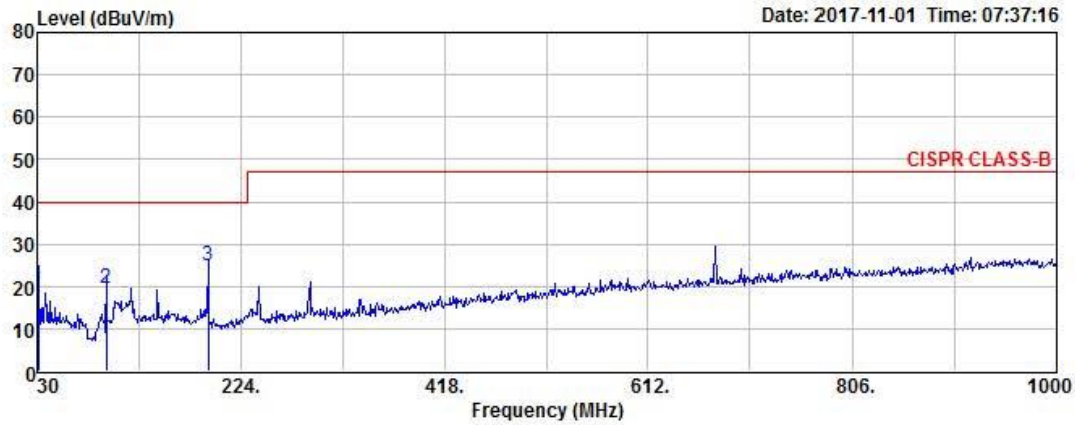
EUT/Model No.: SH-350G Temp/Humi: 23 / 40

Test Mode : Wireless mode(MID) Tested by: BANG Y H

Data: 1776 File: C:\Program Files (x86)\e3\1710-1.EM6 (1780)



Freq	Reading	C.F	Result QP	Limit	Margin	Height	Angle	Polarity
MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	deg	
30.97	36.10	-15.93	20.17	40.00	19.83	351	165	HORIZONTAL
95.96	38.08	-18.66	19.42	40.00	20.58	341	122	HORIZONTAL
192.96	41.68	-16.61	25.07	40.00	14.93	321	320	HORIZONTAL

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain

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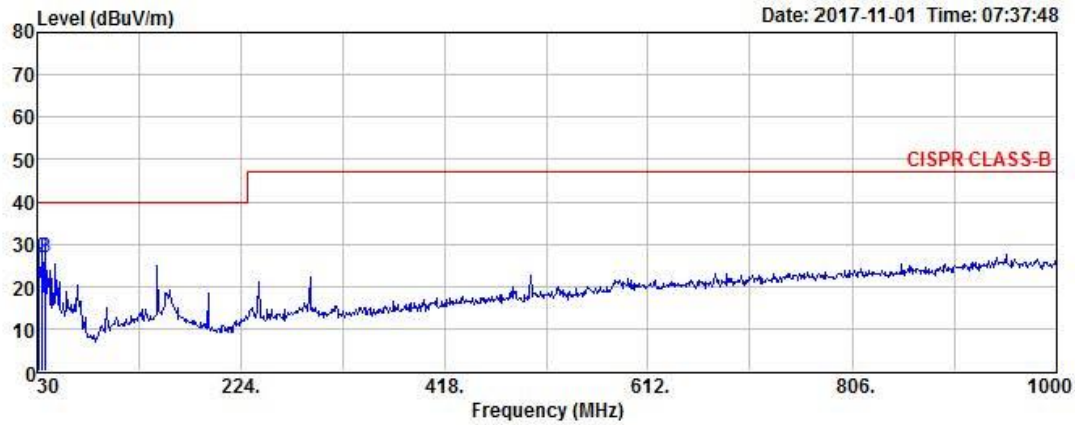
EUT/Model No.: SH-350G Temp/Humi: 23 / 40

Test Mode : Wireless mode(MID) Tested by: BANG Y H

Data: 1775 File: C:\Program Files (x86)\e3\1710-1.EM6 (1780)



Freq	Reading	C.F	Result QP	Limit	Margin	Height	Angle	Polarity
MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	deg	
30.97	42.47	-15.93	26.54	40.00	13.46	100	325	VERTICAL
34.85	42.43	-15.61	26.82	40.00	13.18	105	162	VERTICAL
37.76	42.18	-15.36	26.82	40.00	13.18	132	51	VERTICAL

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain

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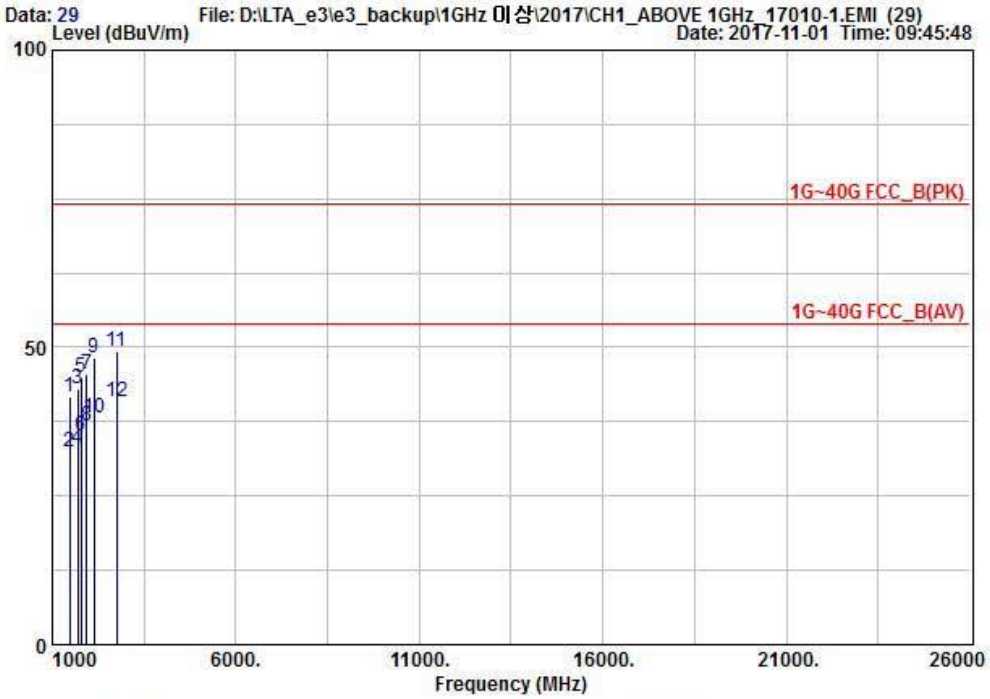
EUT/Model No.: SH-350G Test Mode: Wireless mode(MID)
Tested by : BANG Y H Temp/Humi: 22 / 43



	Freq	Reading	C.F	Result PK	Limit	Margin	Polarity
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	1484.60	45.20	-3.61	41.59	74.00	32.41	VERTICAL
2	1484.60	35.90	-3.61	32.29	54.00	21.71	VERTICAL
3	1683.70	44.90	-1.83	43.07	74.00	30.93	VERTICAL
4	1683.70	34.70	-1.83	32.87	54.00	21.13	VERTICAL
5	1772.60	45.20	-0.35	44.85	74.00	29.15	VERTICAL
6	1772.60	35.50	-0.35	35.15	54.00	18.85	VERTICAL
7	1947.50	44.20	1.24	45.44	74.00	28.56	VERTICAL
8	1947.50	35.60	1.24	36.84	54.00	17.16	VERTICAL
9	2137.40	45.90	2.22	48.12	74.00	25.88	VERTICAL
10	2137.40	35.80	2.22	38.02	54.00	15.98	VERTICAL
11	2742.80	43.90	5.49	49.39	74.00	24.61	VERTICAL
12	2742.80	35.50	5.49	40.99	54.00	13.01	VERTICAL

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain
Blue : Vertical Black : Horizontal

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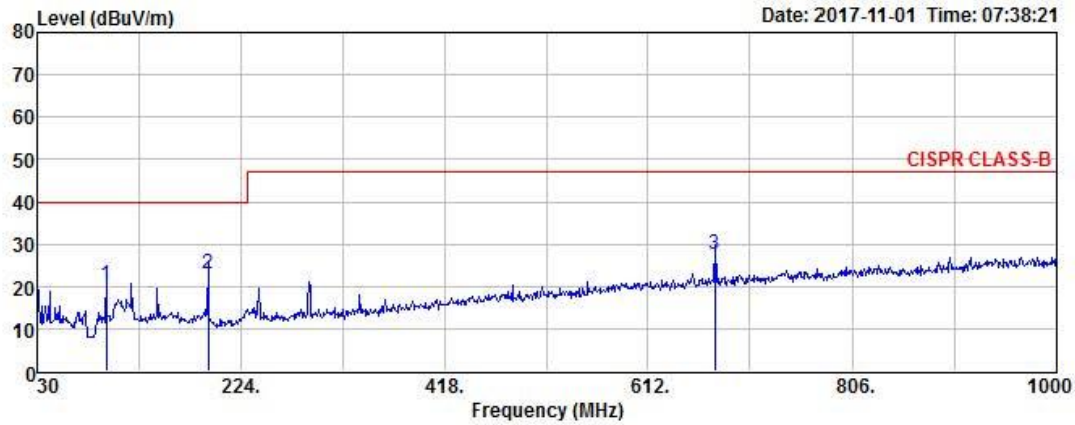
EUT/Model No.: SH-350G Temp/Humi: 23 / 40

Test Mode : Wireless mode(HIGH) Tested by: BANG Y H

Data: 1772 File: C:\Program Files (x86)\e3\1710-1.EM6 (1780)



Freq	Reading	C.F	Result QP	Limit	Margin	Height	Angle	Polarity
MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	deg	
95.96	38.77	-18.66	20.11	40.00	19.89	325	144	HORIZONTAL
192.96	39.39	-16.61	22.78	40.00	17.22	387	152	HORIZONTAL
676.02	34.80	-7.27	27.53	47.00	19.47	351	166	HORIZONTAL

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain

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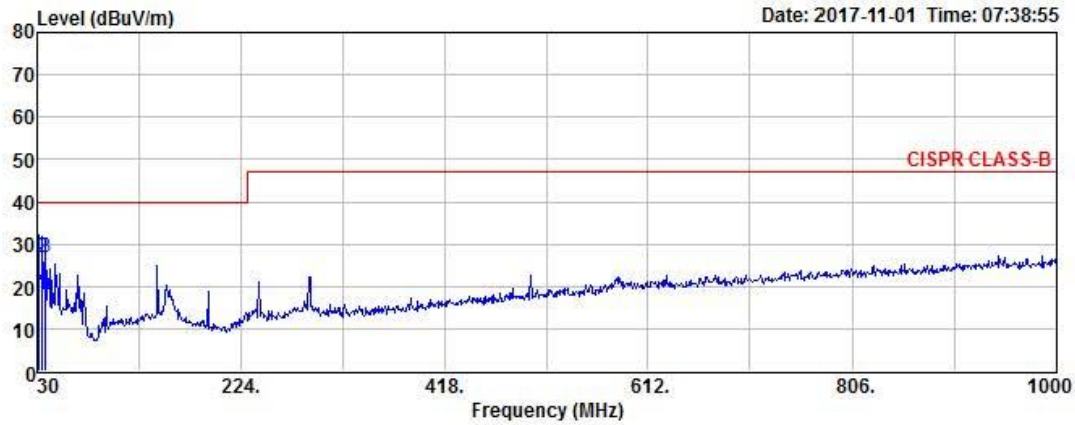
EUT/Model No.: SH-350G Temp/Humi: 23 / 40

Test Mode : Wireless mode(HIGH) Tested by: BANG Y H

Data: 1771 File: C:\Program Files (x86)\e3\1710-1.EM6 (1780)



Freq	Reading	C.F	Result QP	Limit	Margin	Height	Angle	Polarity
MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	deg	
30.97	42.77	-15.93	26.84	40.00	13.16	100	32	VERTICAL
34.85	42.43	-15.61	26.82	40.00	13.18	121	311	VERTICAL
37.76	42.28	-15.36	26.92	40.00	13.08	125	155	VERTICAL

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain

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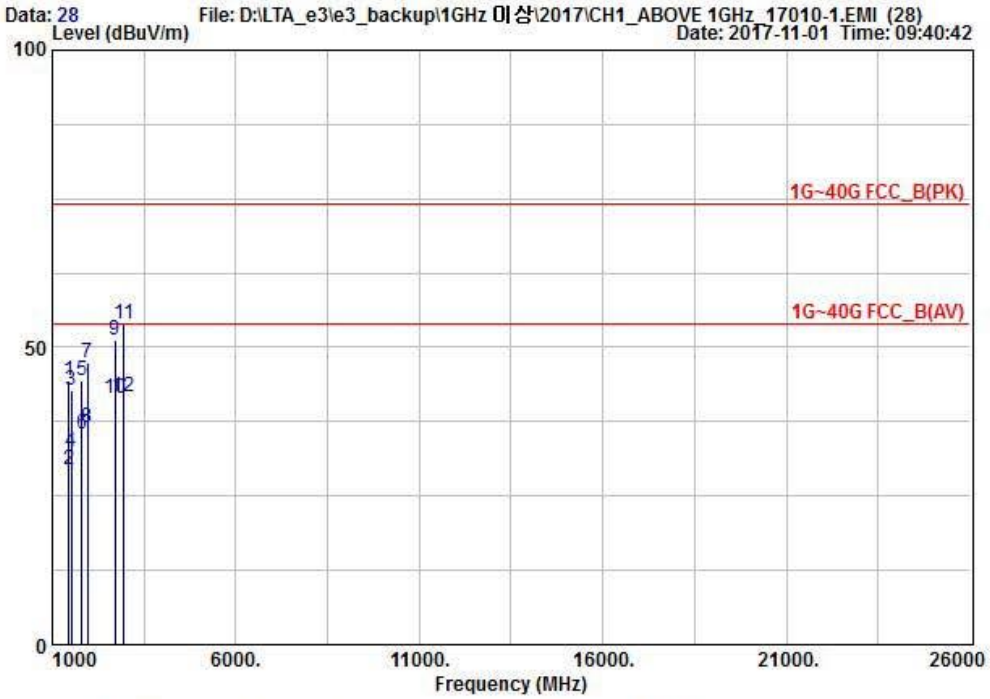
EUT/Model No.: SH-350G Test Mode: Wireless mode(HIGH)
Tested by : BANG Y H Temp/Humi: 22 / 43



	Freq	Reading	C.F	Result PK	Limit	Margin	Polarity
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	1451.21	48.20	-3.81	44.39	74.00	29.61	VERTICAL
2	1451.21	33.10	-3.81	29.29	54.00	24.71	VERTICAL
3	1527.92	45.90	-3.24	42.66	74.00	31.34	VERTICAL
4	1527.92	35.60	-3.24	32.36	54.00	21.64	VERTICAL
5	1798.50	44.60	-0.24	44.36	74.00	29.64	VERTICAL
6	1798.50	35.80	-0.24	35.56	54.00	18.44	VERTICAL
7	1955.70	46.20	1.29	47.49	74.00	26.51	VERTICAL
8	1955.70	35.30	1.29	36.59	54.00	17.41	VERTICAL
9	2714.60	45.80	5.41	51.21	74.00	22.79	VERTICAL
10	2714.60	35.90	5.41	41.31	54.00	12.69	VERTICAL
11	2954.60	46.70	7.25	53.95	74.00	20.05	VERTICAL
12	2954.60	34.50	7.25	41.75	54.00	12.25	VERTICAL

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain
Blue : Vertical Black : Horizontal

3.3.9 AC Conducted Emissions

Procedure:

AC power line conducted emissions from the EUT were measured according to the dictates of ANSI C63.4:2003. The conducted emissions are measured in the shielded room with a spectrum analyzer in peak hold. While the measurement, EUT had its hopping function disabled at the middle channels in line with Section 15.31(m). Emissions closest to the limit are measured in the quasi-peak mode (QP) with the tuned receiver using a bandwidth of 9 kHz. The emissions are maximized further by cable manipulation and Exerciser operation. The highest emissions relative to the limit are listed.

Measurement Data: Complies

- Refer to the next page.
- No other emissions were detected at a level greater than 20dB below limit
- It gave the worse case emissions

Minimum Standard: FCC Part 15.207(a)/EN 55022

Frequency Range (MHz)	Conducted Limit (d. 1t892ㅂ BuV)	
	Quasi-Peak	Average
0.15 ~ 0.5	66 to 56 *	56 to 46 *
0.5 ~ 5	56	46
5 ~ 30	60	50

* Note: The limits will decrease with the frequency logarithmically within 0.15MHz to 0.5MHz

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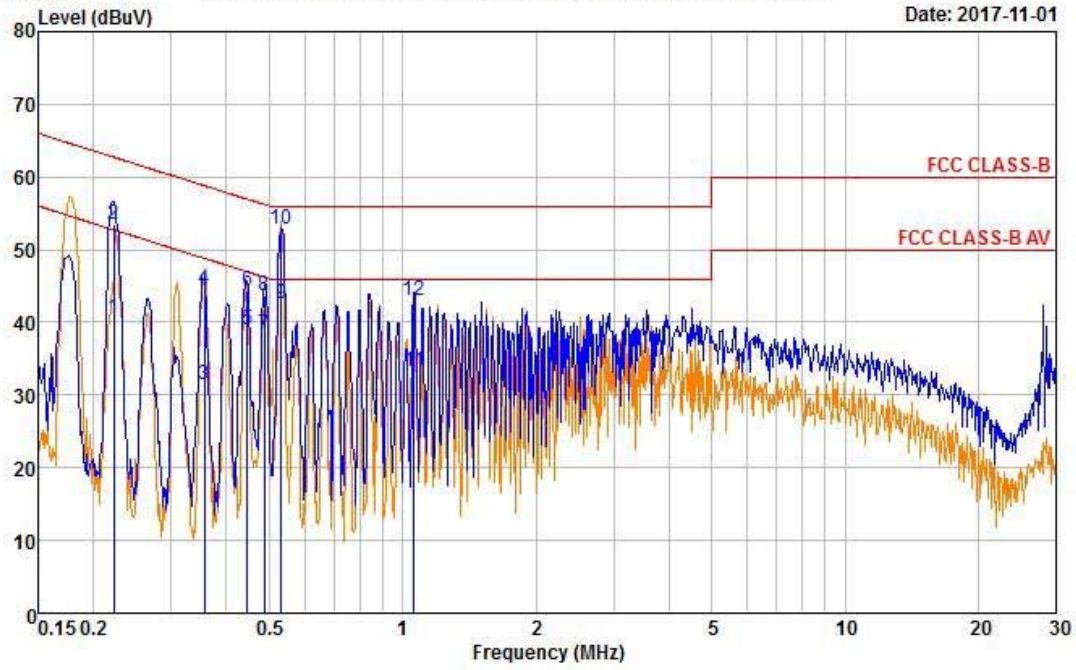
EUT / Model No.	: SH-350G	Phase	: LINE
Test Mode	: Wireless mode(LOW)	Test Power	: 120 / 60
Temp. / Humi.	: 25 / 41	Test Engineer	: BANG Y H

Data: 2654 File: D:\Conducted Data\2017\LTA_Conduction_2017_10 .EM6 (2654)



Freq	RD QP	RD AV	C.F	Result QP	Result AV	Limit QP	Limit AV	Margin QP	Margin AV
MHz	dBuA	dBuA	dB	dBuA	dBuA	dBuA	dBuA	dB	dB
0.222	33.98	21.18	19.48	53.46	40.66	62.73	52.73	9.27	12.07
0.356	24.98	11.88	19.50	44.48	31.38	58.82	48.82	14.34	17.44
0.445	24.95	19.55	19.50	44.45	39.05	56.97	46.97	12.52	7.92
0.487	24.23	18.84	19.51	43.74	38.35	56.22	46.22	12.48	7.87
0.532	33.26	23.16	19.51	52.77	42.67	56.00	46.00	3.23	3.33
1.063	23.53	13.60	19.53	43.06	33.13	56.00	46.00	12.94	12.87

Remarks: C.F (Correction Factor) = Insertion loss + Cable loss + Pulse Limiter

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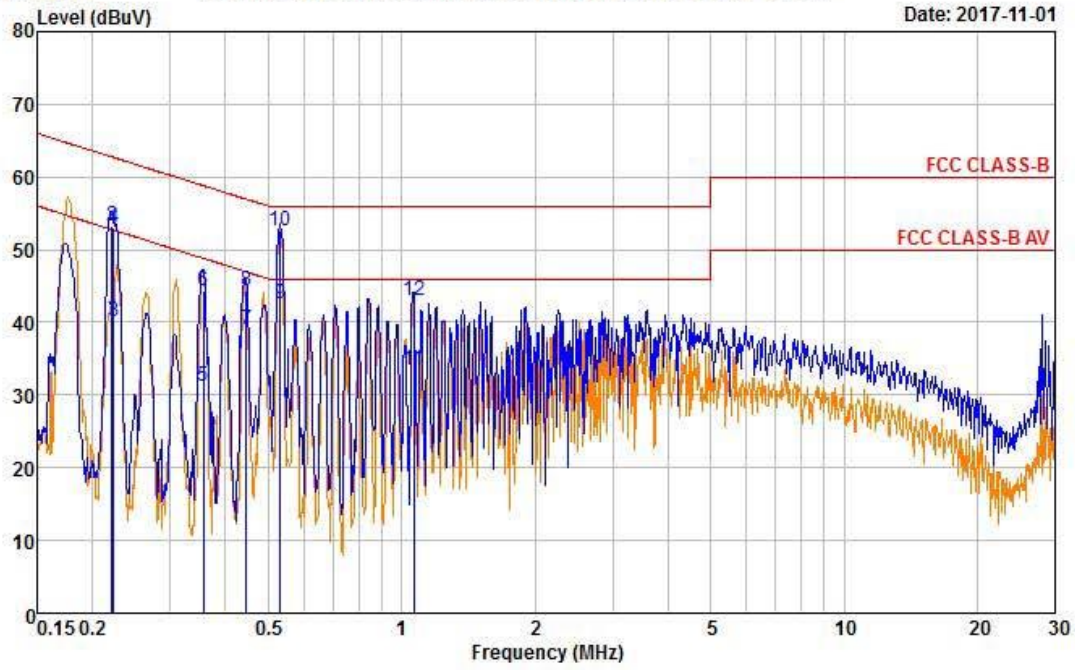
EUT / Model No.	: SH-350G	Phase	: NEUTRAL
Test Mode	: Wireless mode(LOW)	Test Power	: 120 / 60
Temp. / Humi.	: 25 / 41	Test Engineer	: BANG Y H

Data: 2658 File: D:\Conducted Data\2017\LTA_Conduction_2017_10 .EM6 (2658)



Freq	RD QP	RD AV	C.F	Result QP	Result AV	Limit QP	Limit AV	Margin QP	Margin AV
MHz	dBuA	dBuA	dB	dBuA	dBuA	dBuA	dBuA	dB	dB
0.222	33.77	21.14	19.49	53.26	40.63	62.75	52.75	9.49	12.12
0.223	33.45	20.51	19.49	52.94	40.00	62.69	52.69	9.75	12.69
0.356	24.85	11.80	19.50	44.35	31.30	58.83	48.83	14.48	17.53
0.445	24.81	19.40	19.50	44.31	38.90	56.97	46.97	12.66	8.07
0.532	33.12	23.13	19.50	52.62	42.63	56.00	46.00	3.38	3.37
1.064	23.54	13.81	19.52	43.06	33.33	56.00	46.00	12.94	12.67

Remarks: C.F (Correction Factor) = Insertion loss + Cable loss + Pulse Limiter

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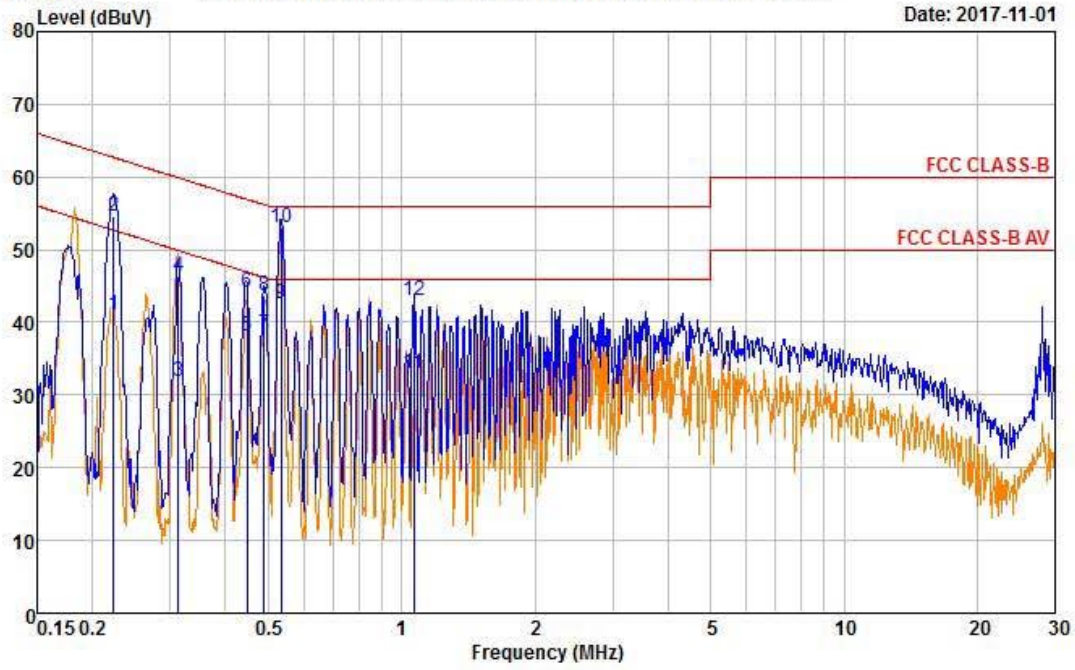
EUT / Model No.	: SH-350G	Phase	: LINE
Test Mode	: Wireless mode(MID)	Test Power	: 120 / 60
Temp. / Humi.	: 25 / 41	Test Engineer	: BANG Y H

Data: 2650 File: D:\Conducted Data\2017\LTA_Conduction_2017_10 .EM6 (2650)



Freq	RD QP	RD AV	C.F	Result QP	Result AV	Limit QP	Limit AV	Margin QP	Margin AV
MHz	dBuA	dBuA	dB	dBuA	dBuA	dBuA	dBuA	dB	dB
0.223	35.01	21.60	19.48	54.49	41.08	62.70	52.70	8.21	11.62
0.313	26.82	12.32	19.50	46.32	31.82	59.89	49.89	13.57	18.07
0.447	24.63	18.71	19.50	44.13	38.21	56.94	46.94	12.81	8.73
0.489	24.10	18.92	19.51	43.61	38.43	56.18	46.18	12.57	7.75
0.534	33.42	23.16	19.51	52.93	42.67	56.00	46.00	3.07	3.33
1.067	23.47	13.46	19.53	43.00	32.99	56.00	46.00	13.00	13.01

Remarks: C.F (Correction Factor) = Insertion loss + Cable loss + Pulse Limiter

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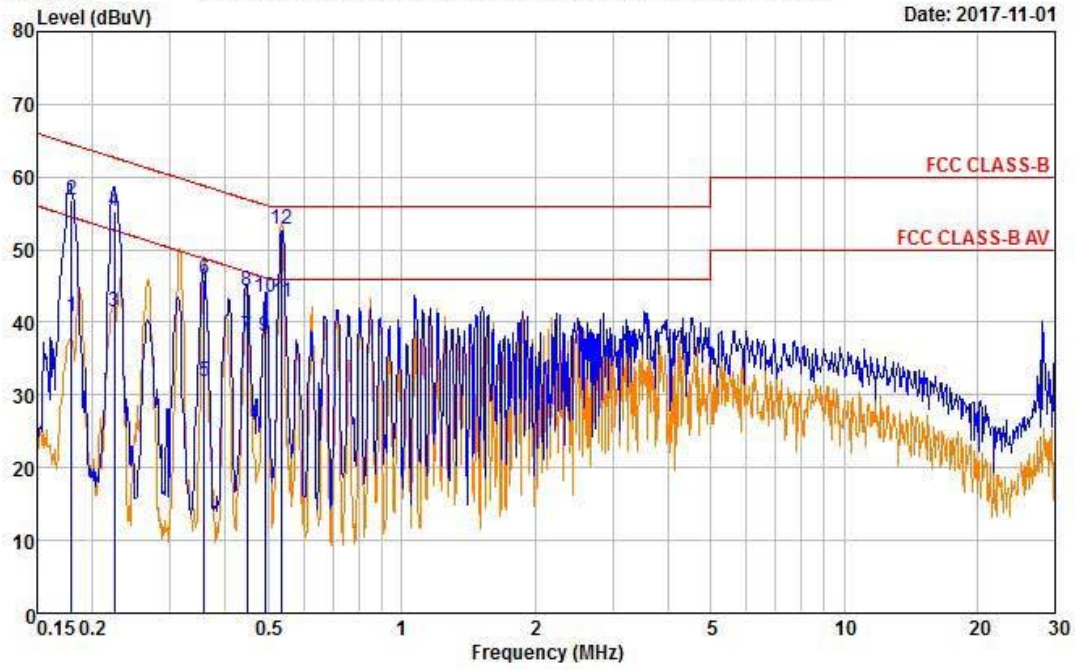
EUT / Model No.	: SH-350G	Phase	: NEUTRAL
Test Mode	: Wireless mode(MID)	Test Power	: 120 / 60
Temp. / Humi.	: 25 / 41	Test Engineer	: BANG Y H

Data: 2646 File: D:\Conducted Data\2017\LTA_Conduction_2017_10 .EM6 (2646)



Freq	RD QP	RD AV	C.F	Result QP	Result AV	Limit QP	Limit AV	Margin QP	Margin AV
MHz	dBuA	dBuA	dB	dBuA	dBuA	dBuA	dBuA	dB	dB
0.179	37.36	21.34	19.48	56.84	40.82	64.52	54.52	7.68	13.70
0.224	35.74	21.94	19.49	55.23	41.43	62.67	52.67	7.44	11.24
0.358	26.34	12.45	19.50	45.84	31.95	58.77	48.77	12.93	16.82
0.448	24.82	18.70	19.50	44.32	38.20	56.92	46.92	12.60	8.72
0.490	23.86	18.59	19.50	43.36	38.09	56.16	46.16	12.80	8.07
0.536	33.25	23.23	19.50	52.75	42.73	56.00	46.00	3.25	3.27

Remarks: C.F (Correction Factor) = Insertion loss + Cable loss + Pulse Limiter

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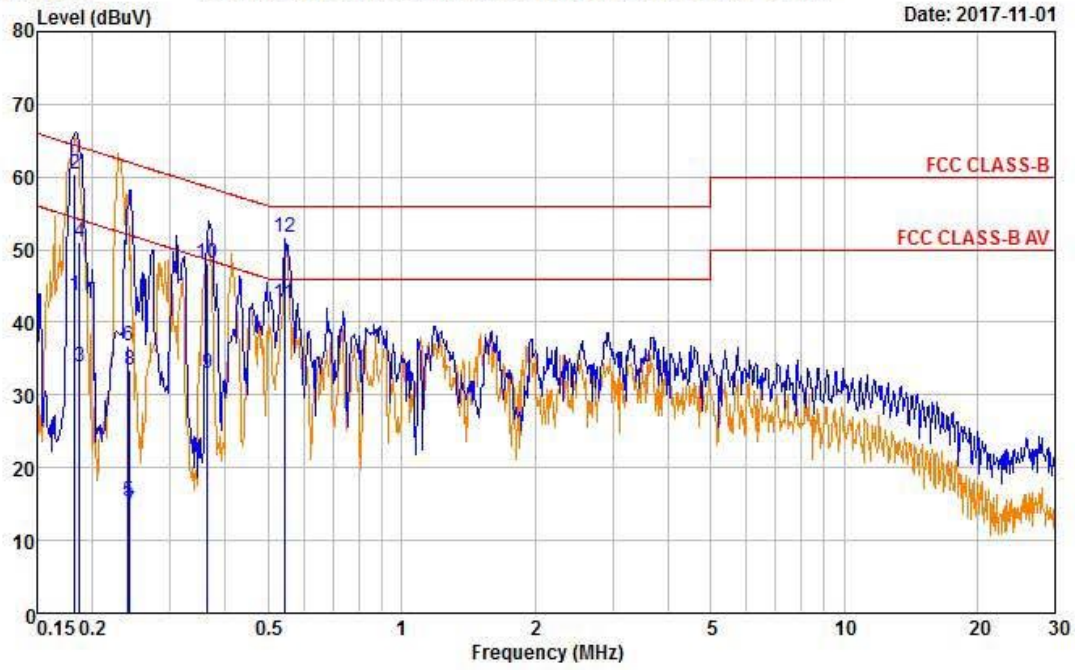
EUT / Model No.	: SH-350G	Phase	: LINE
Test Mode	: Wireless mode(HIGH)	Test Power	: 120 / 60
Temp. / Humi.	: 25 / 41	Test Engineer	: BANG Y H

Data: 2638 File: D:\Conducted Data\2017\LTA_Conduction_2017_10 .EM6 (2638)



Freq	RD QP	RD AV	C.F	Result QP	Result AV	Limit QP	Limit AV	Margin QP	Margin AV
MHz	dBuA	dBuA	dB	dBuA	dBuA	dBuA	dBuA	dB	dB
0.182	40.82	24.27	19.48	60.30	43.75	64.37	54.37	4.07	10.62
0.187	31.46	14.44	19.48	50.94	33.92	64.15	54.15	13.21	20.23
0.241	17.33	-4.08	19.49	36.82	15.41	62.08	52.08	25.26	36.67
0.243	13.92	-5.40	19.49	33.41	14.09	61.99	51.99	28.58	37.90
0.364	28.54	13.59	19.50	48.04	33.09	58.65	48.65	10.61	15.56
0.544	32.18	23.15	19.51	51.69	42.66	56.00	46.00	4.31	3.34

Remarks: C.F (Correction Factor) = Insertion loss + Cable loss + Pulse Limiter

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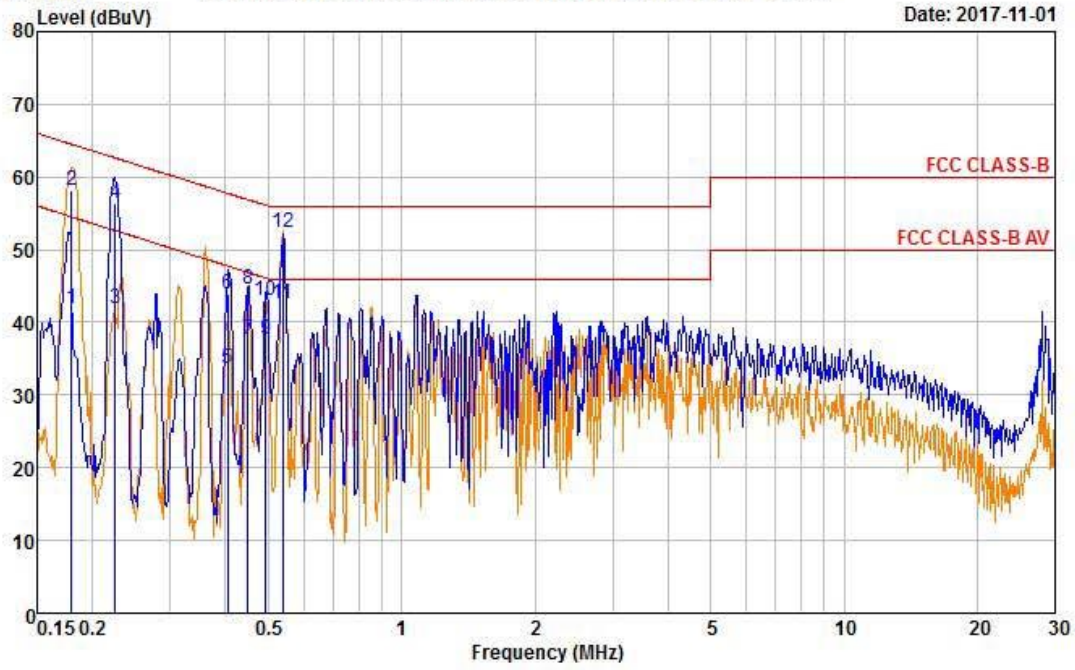
EUT / Model No.	: SH-350G	Phase	: NEUTRAL
Test Mode	: Wireless mode(HIGH)	Test Power	: 120 / 60
Temp. / Humi.	: 25 / 41	Test Engineer	: BANG Y H

Data: 2642 File: D:\Conducted Data\2017\LTA_Conduction_2017_10 .EM6 (2642)



Freq	RD QP	RD AV	C.F	Result QP	Result AV	Limit QP	Limit AV	Margin QP	Margin AV
MHz	dBuA	dBuA	dB	dBuA	dBuA	dBuA	dBuA	dB	dB
0.179	38.65	22.47	19.48	58.13	41.95	64.51	54.51	6.38	12.56
0.225	36.79	22.36	19.49	56.28	41.85	62.62	52.62	6.34	10.77
0.405	24.43	14.26	19.50	43.93	33.76	57.75	47.75	13.82	13.99
0.450	25.14	18.26	19.50	44.64	37.76	56.88	46.88	12.24	9.12
0.493	23.41	18.27	19.50	42.91	37.77	56.12	46.12	13.21	8.35
0.538	32.94	23.17	19.50	52.44	42.67	56.00	46.00	3.56	3.33

Remarks: C.F (Correction Factor) = Insertion loss + Cable loss + Pulse Limiter

APPENDIX

TEST EQUIPMENT USED FOR TESTS

	Use	Description	Model No.	Serial No.	Manufacturer	Interval	Last Cal. Date
1	■	Signal Analyzer (9 kHz ~ 30 GHz)	FSV30	100757	R&S	1 year	2017-09-07
2	■	Signal Generator (~3.2 GHz)	8648C	3623A02597	HP	1 year	2017-03-20
3		SYNTHESIZED CW GENERATOR	83711B	US34490456	HP	1 year	2017-03-20
4		Attenuator (3 dB)	8491A	37822	HP	1 year	2017-09-07
5		Attenuator (10 dB)	8491A	63196	HP	1 year	2017-09-07
6	■	EMI Test Receiver (~7 GHz)	ESCI7	100722	R&S	1 year	2017-09-07
7	■	RF Amplifier (~1.3 GHz)	8447D OPT 010	2944A07684	HP	1 year	2017-09-07
8	■	RF Amplifier (1~26.5 GHz)	8449B	3008A02126	HP	1 year	2017-03-21
9	■	Horn Antenna (1~18 GHz)	3115	00114105	ETS	2 year	2016-08-04
10		DRG Horn (Small)	3116B	81109	ETS-Lindgren	2 year	2016-05-03
11	■	DRG Horn (Small)	3116B	133350	ETS-Lindgren	2 year	2016-05-03
12	■	TRILOG Antenna	VULB 9160	9160-3237	SCHWARZBECK	2 year	2017-04-17
13		Temp.Humidity Data Logger	SK-L200TH II A	00801	SATO	1 year	2017-03-21
14		Splitter (SMA)	ZFSC-2-2500	SF617800326	Mini-Circuits	-	-
15	■	DC Power Supply	6674A	3637A01657	Agilent	-	-
16		Frequency Counter	5342A	2826A12411	HP	1 year	2017-03-21
17	■	Power Meter	EPM-441A	GB32481702	HP	1 year	2017-03-20
18	■	Power Sensor	8481A	3318A94972	HP	1 year	2016-12-30
19		Audio Analyzer	8903B	3729A18901	HP	1 year	2017-09-07
20		Modulation Analyzer	8901B	3749A05878	HP	1 year	2017-09-07
21		TEMP & HUMIDITY Chamber	YJ-500	LTAS06041	JinYoung Tech	1 year	2017-09-07
22		Stop Watch	HS-3	812Q08R	CASIO	2 year	2017-03-21
23	■	LISN	KNW-407	8-1430-1	Kyoritsu	1 year	2017-09-07
24	■	Two-Lime V-Network	ESH3-Z5	893045/017	R&S	1 year	2017-03-20
25		UNIVERSAL RADIO COMMUNICATION TESTER	CMU200	106243	R&S	1 year	2017-03-20
26		Highpass Filter	WHKX1.5/15G-10SS	74	Wainwright Instruments	1 year	2017-03-20
27		Highpass Filter	WHKX3.0/18G-10SS	118	Wainwright Instruments	1 year	2017-03-20
28		OSP120 BASE UNIT	OSP120	101230	R&S	1 year	2017-03-21
29		Signal Generator(100 kHz ~ 40 GHz)	SMB100A03	177621	R&S	1 year	2017-03-23
30		Signal Analyzer (10 Hz ~ 40 GHz)	FSV40	101367	R&S	1 year	2017-03-21